UNIV. OF
TORONTO
LIBRARY

M.

THE MONIST

A QUARTERLY MAGAZINE

DEVOTED TO THE PHILOSOPHY OF SCIENCE

VOLUME XXIV

13965-1
-27/9/16.

CHICAGO
THE OPEN COURT PUBLISHING COMPANY
1914

B
1
M7
v.24

COPYRIGHT BY
THE OPEN COURT PUBLISHING CO.
1913-1914

CONTENTS OF VOLUME XXIV.

ARTICLES AND AUTHORS.

PAGE

Acquaintance, On the Nature of. By Bertrand Russell..... 1, 151, 435
Agnew, P. G. "Multiplication of Pears and Pence" 155
Anderson, K. C. The Person of Jesus Christ in the Christian Faith, 333; The Significance of the Historicity Problem, 634.
Bergson, An Answer to Mr. Bertrand Russell's Article on the Philosophy of. By Karin Costelloe 145
Buddhism, The Development of Mahayana. By Daisetz Teitaro Suzuki. 565
Buddhist Influence in the Gospels. By Richard Garbe 481
Carus, Paul. Death (Poem), 284; The Religion of Tragedy and the Christ-Ideal, 362.
Ceremonial Spitting. By A. H. Godbey 68
Chemical Origin and Regulation of Life. By Leonard Thompson Troland 92
Christ-Ideal, The Religion of Tragedy and the. By Paul Carus 362
Christian Elements in Later Krishnaism and in Other Hinduistic Sects. By Richard Garbe 35
Christianity, Gentile Elements in. By Richard Garbe 454
Costelloe, Karin. An Answer to Mr. Bertrand Russell's Article on the Philosophy of Bergson 145
Current Periodicals 315, 475, 638
Death (Poem). By Paul Carus 284
Definitions and Methodological Principles in Theory of Knowledge. By Bertrand Russell 582
Deussen's Philosophy of the Bible 460
De Vries, Hugo. The Probable Origin of *Oenothera Lamarkiana* Ser... 594
Economy of Thought. By Philip E. B. Jourdain 134
Garbe, Richard. Buddhist Influence in the Gospels, 481; Christian Elements in Later Krishnaism and in Other Hinduistic Sects, 35; Gentile Elements in Christianity, 454.
Gentile Elements in Christianity . By Richard Garbe 454
Gilbert, Leo, on the Principle of Relativity 288
Godbey, A. H. Ceremonial Spitting 68
Gospels, Buddhist Influence in the. By Richard Garbe 481
Henke, Frederick G. Wang Yang Ming, a Chinese Idealist 17
Historicity Problem, The Significance of the. By K. C. Anderson 634

PAGE
Jesus, Are We Just to? By A. Kampmeier 395
Jesus Christ in the Christian Faith, The Person of. By K. C. Anderson.. 333
Jesus-Question, Latest Lights and Shadows on the. By William Benjamin Smith 618
Jourdain, Philip E. B. The Economy of Thought, 134; The Principles of Mechanics with Newton (1666-1679), 188; (1679-1687), 515.
Kampmeier, A. Are We Just to Jesus? 395
Knowledge, Definitions and Methodological Principles in Theory of. By Bertrand Russell 582
Life, The Chemical Origin and Regulation of. By Leonard T. Troland.. 92
Life, Purposiveness in Nature and. By Edmund Noble 259
Magic Squares, Associated Prime Number. By Charles D. Shuldham... 472
Magic Squares, Pandiagonal Prime Number. By Charles D. Shuldham.. 608
Magic Squares, Paneled . By Charles D. Shuldham 613
Mechanics, The Principle of, with Newton. By Philip E. B. Jourdain, 188, 515
More, Louis Trenchard. The Units of Measure and the Principle of Relativity 225
Multiplication of Pears and Pence. By P. G. Agnew 155
Newton, The Principles of Mechanics with. By Philip E. B. Jourdain, 188, 515
Noble, Edmund. Purposiveness in Nature and Life 259
Oenothera Lamarckiana Ser, The Probable Origin of. By Hugo De Vries 594
Peirce, Charles S., In Memoriam. By Francis C. Russell 469
Philosophy, Fifth International Congress of. London, 1915 636
Realistic World-Conception, Eduard Study's 309
Relativity, A Satire on the Principle of (Leo Gilbert) 288
Relativity, The Units of Measure and the Principle of. By Louis Trenchard More 225
Religion of Tragedy and the Christ-Ideal, The. By Paul Carus 362
Russell, Bertrand. On the Nature of Acquaintance: I. Preliminary Description of Experience, 1; II. Neutral Monism, 161; III. Analysis of Experience, 435.—Definitions and Methodological Principles in Theory of Knowledge, 582.
Russell's Article on the Philosophy of Bergson, An Answer to. By Karin Costelloe 145
Russell, Francis C. In Memoriam Charles S. Peirce 469
Shuldham, Charles D. Associated Prime Number Magic Squares, 472; Pandiagonal Prime Number Magic Squares, 608; Paneled Magic Squares, 613.
Smith, William Benjamin. The Critical Trilemma, 411; Latest Lights and Shadows on the Jesus-Question, 618.
Study's, Eduard, Realistic World-Conception 309
Suzuki, Daisetz Teitaro. The Development of Mahayana Buddhism 565
Thomas, Calvin. Tragedy and the Enjoyment of it 321
Thought, The Economy of. By Philip E. B. Jourdain 134
Tragedy and the Christ-Ideal, The Religion of. By Paul Carus 362
Tragedy and the Enjoyment of it. By Calvin Thomas 321
Trilemma, The Critical. By William Benjamin Smith. 411
Troland, Leonard Thompson. The Chemical Origin and Regulation of Life 92

PAGE
Units of Measure and the Principle of Relativity. By Louis Trenchard More 225
Unity of World-Conception. By Arthur Silva White 493
Wang Yang Ming, a Chinese Idealist. By Frederick G. Henke 17
White, Arthur Silva. Unity of World-Conception 493
World-Conception, Eduard Study's Realistic 309
World-Conception, Unity of. By Arthur Silva White 493

BOOK REVIEWS AND NOTES.

Deussen, Paul. Die Philosophie der Bibel 460
Gilbert, Leo. Das Relativitätsprinzip 288
Isis 318, 640
Jacks, L. P. The Alchemy of Thought 158
Revue de Métaphysique et de Morale 475, 639
Scientia (Rivista di Scienza) 315, 476 638
Study, Eduard. Die realistische Weltansicht 309

Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

http://www.archive.org/details/monistquart24hegeuoft

VOL. XXIV. JANUARY, 1914. NO. 1

THE MONIST

ON THE NATURE OF ACQUAINTANCE.

PRELIMINARY DESCRIPTION OF EXPERIENCE.

THE purpose of what follows is to advocate a certain analysis of the simplest and most pervading aspect of experience, namely what I call "acquaintance." It will be maintained that acquaintance is a dual relation between a subject and an object which need not have any community of nature. The subject is "mental," the object is not known to be mental except in introspection. The object may be in the present, in the past, or not in time at all; it may be a sensible particular, or a universal, or an abstract logical fact. All cognitive relations—attention, sensation, memory, imagination, believing, disbelieving, etc.—presuppose acquaintance.

This theory has to be defended against three rival theories: (1) the theory of Mach and James, according to which there is no distinctive relation such as "acquaintance," involved in all mental facts, but merely a different grouping of the same objects as those dealt with by non-psychological sciences; (2) the theory that the immediate object is mental, as well as the subject; (3) the theory that between subject and object there is a third entity, the "content," which is mental, and is that thought or state of mind by means of which the subject apprehends the object. The first of these rivals is the most interesting and the most formidable, and can only be met by a full and detailed

discussion, which will occupy a second essay. The other theories, along with my own, will be considered in a third essay, while the first essay will consist of an introductory survey of data.

The word "experience," like most of the words expressing fundamental ideas in philosophy, has been imported into the technical vocabulary from the language of daily life, and it retains some of the grime of its outdoor existence in spite of some scrubbing and brushing by impatient philosophers. Originally, the "philosophy of experience" was opposed to the *a priori* philosophy, and "experience" was confined to what we learn through the senses. Gradually, however, its scope widened until it included everything of which we are in any way conscious, and became the watchword of an emaciated idealism imported from Germany. The word had, on the one hand, the reassuring associations of the "appeal to experience," which seemed to preclude the wilder vagaries of transcendental metaphysicians; while on the other hand it held, as it were in solution, the doctrine that nothing can happen except as the "experience" of some mind. Thus by the use of this one word the idealists cunningly forced upon their antagonists the odium of the *a priori* and the apparent necessity of maintaining the bare dogma of an unknowable reality, which must, it was thought, be either wholly arbitrary or not really unknowable.

In the revolt against idealism, the ambiguities of the word "experience" have been perceived, with the result that realists have more and more avoided the word. It is to be feared, however, that if the word is avoided the confusions of thought with which it has been associated may persist. It seems better to persevere in the attempt to analyze and clarify the somewhat vague and muddy ideas commonly called up by the word "experience," since it is not improbable that in this process we may come upon

something of fundamental importance to the theory of knowledge.

A certain difficulty as regards the use of words is unavoidable here, as in all philosophical inquiries. The meanings of common words are vague, fluctuating and ambiguous, like the shadow thrown by a flickering street-lamp on a windy night; yet in the nucleus of this uncertain patch of meaning, we may find some precise concept for which philosophy requires a name. If we choose a new technical term, the connection with ordinary thought is obscured and the clarifying of ordinary thought is retarded; but if we use the common word with a new precise significance, we may seem to run counter to usage, and we may confuse the reader's thoughts by irrelevant associations. It is impossible to lay down a rule for the avoidance of these opposite dangers; sometimes it will be well to introduce a new technical term, sometimes it will be better to polish the common word until it becomes suitable for technical purposes. In the case of "experience," the latter course seems preferable, since the actual process of polishing the word is instructive, and the confusions of thought which it covers cannot well be otherwise dispelled.

In seeking the central idea embodied in the word "experience," we shall at the same time be performing the analysis required for a definition of "mind" and "mental." Common sense divides human beings into souls and bodies, and Cartesian philosophy generalized this division by classifying everything that exists as either mind or matter. This division is so familiar, and of such respectable antiquity, that it has become part of our habits, and seems scarcely to embody a theory. Mind is what we know from within—thoughts and feelings and volitions—while matter is what is in space outside our minds. Nevertheless, almost all the great philosophers since Leibniz have challenged the dualism of mind and matter. Most of them, regarding

mind as something immediately given, have assimilated to it what appeared to be "matter," and have thus achieved the monism of the idealist. We may define an idealist as a man who believes that whatever exists may be called "mental," in the sense of having a certain character, known to us by introspection as belonging to our own minds. In recent times, however, this theory has been criticized from various points of view. On the one hand, men who admitted that we know by introspection things having the character we call "mental" have urged that we also know other things not having this character. On the other hand, William James and the American realists have urged that there is no specific character of "mental" things, but that the things which are called mental are identical with the things which are called physical, the difference being merely one of context and arrangement.

We have thus three opinions to consider. There are first those who deny that there is a character called "mental" which is revealed in introspection. These men may be called "neutral monists," because, while rejecting the division of the world into mind and matter, they do not say "all reality is mind," nor yet "all reality is matter." Next, there are "idealistic monists," who admit a character called "mental," and hold that everything has this character. Next, there are "dualists," who hold that there is such a character, but that there are things which do not possess it. In order to decide among these views, it is necessary to decide whether anything is meant by the word "mental"; and this inquiry brings us back to the meaning of "experience."

When we consider the world without the knowledge and the ignorance that are taught by philosophy, we seem to see that it contains a number of things and persons, and that some of the things are "experienced" by some of the persons. A man may experience different things at dif-

ferent times, and different men may experience different things at the same time. Some things, such as the inside of the earth or the other side of the moon, are never experienced by anybody, but are nevertheless believed to exist. The things which a man is said to experience are the things that are given in sensation, his own thoughts and feelings (at any rate so far as he is aware of them), and perhaps (though on this point common sense might hesitate) the facts which he comes to know by thinking. At any given moment, there are certain things of which a man is "aware," certain things which are "before his mind." Now although it is very difficult to define "awareness," it is not at all difficult to say that I am aware of such and such things. If I am asked, I can reply that I am aware of this, and that, and the other, and so on through a heterogeneous collection of objects. If I describe these objects, I may of course describe them wrongly; hence I cannot with certainty communicate to another what are the things of which I am aware. But if I speak to myself, and denote them by what may be called "proper names," rather than by descriptive words, I cannot be in error. So long as the names which I use really are names at the moment, i. e., are naming things to me, so long the things must be objects of which I am aware, since otherwise the words would be meaningless sounds, not names of things. There is thus at any given moment a certain assemblage of objects to which I could, if I chose, give proper names; these are the objects of my "awareness," the objects "before my mind," or the objects that are within my present "experience."

There is a certain unity, important to realize but hard to analyze, in "my present experience." If we assumed that "I" am the same at one time and at another, we might suppose that "my present experience" might be defined as all the experience which "I" have "now." But in fact

we shall find that "I" and "now," in the order of knowledge, must be defined in terms of "my present experience," rather than *vice versa*. Moreover, we cannot define "my present experience" as "all experience contemporaneous with *this*" (where *this* is some actual part of what I now experience), since that would ignore the possibility of experience other than mine. Nor can we define it as "all experience which I experience as contemporaneous with *this*," since that would exclude all that part of my experiencing of which I do not become introspectively conscious. We shall have to say, I think, that "being experienced together" is a relation between experienced things, which can itself be experienced, for example when we become aware of two things which we are seeing together, or of a thing seen and a thing heard simultaneously. Having come to know in this way what is meant by "being experienced together," we can define "my present contents of experience" as "everything experienced together with *this*," where *this* is any experienced thing selected by attention. We shall return to this topic on several subsequent occasions.

I do not propose as yet to attempt a logical analysis of "experience." For the present, I wish to consider its extent, its boundaries, its prolongation in time, and the reasons for regarding it as not all-embracing. These topics may be dealt with by discussing successively the following questions: (1) Are faint and peripheral sensations included in "experience"? (2) Are all or any of our present true beliefs included in present "experience"? (3) Do we now "experience" past things which we remember? (4) How do we come to know that the group of things now experienced is not all-embracing? (5) Why do we regard our present and past experiences as all parts of *one* experience, namely the experience which we call "ours"? (6) What leads us to believe that "our" total

experience is not all-embracing? Many of these questions will have to be discussed again more fully at a later stage; for the present, we are not discussing them on their own account, but in order to become familiar with the notion of experience.

1. Are faint and peripheral sensations included in "experience"? This question may be asked, not only with regard to sensations, but also with regard to faint wishes, dim thoughts, and whatever else is not in the focus of attention; but for illustrative purposes, the case of sensation, which is the simplest, may suffice. For the sake of definiteness, let us consider the field of vision. Normally, if we are attending to anything seen, it is to what is in the center of the field that we attend, but we can, by an effort of will, attend to what is in the margin. It is obvious that, when we do so, what we attend to is indubitably experienced. Thus the question we have to consider is whether *attention* constitutes experience, or whether things not attended to are also experienced. It seems we must admit things to which we do not attend, for attention is a selection among objects that are "before the mind," and therefore presupposes a larger field, constituted in some less exclusive manner, out of which attention chooses what it wants. In cases, however, where, in spite of the physical conditions which might be expected to produce a sensation, no sensation appears to exist, as for example when we fail to hear a faint sound which we should hear if our attention were called to it, it would seem that there is no corresponding "experience"; in such cases, in spite of the physical existence of the sound-stimulus, there seems to be sometimes no answering "mental" existent.

2. Our mental life is largely composed of beliefs, and of what we are pleased to call "knowledge" of "facts." When I speak of a "fact," I mean the kind of thing that is expressed by the phrase "that so-and-so is the case." A

"fact" in this sense is something different from an existing sensible thing; it is the kind of object towards which we have a *belief,* expressed in a proposition. The question I am asking now is not whether believing is experienced, for that I take to be obvious; the question is, whether the facts towards which beliefs are directed are ever experienced. It is obvious at once that most of the facts which we consider to be within our knowledge are not experienced. We do not experience that the earth goes round the sun, or that London has six million inhabitants, or that Napoleon was defeated at Waterloo. I think, however, that some facts are experienced, namely those which we see for ourselves, without relying either upon our own reasoning from previous facts, or upon the testimony of others. These "primitive" facts, which are known to us by an immediate insight as luminous and indubitable as that of sense, must, if I am not mistaken, be included in the original matter of experience. Their importance in the theory of knowledge is very great, and we shall have occasion to consider them very fully in the sequel.

3. Do we now experience past things which we remember? We cannot of course discuss this question adequately without a consideration of the psychology of memory. But in a brief preliminary way, something may be said to indicate an affirmative conclusion. In the first place, we must not confound true memory with present images of past things. I may call up now before my mind an image of a man I saw yesterday; the image is not in the past, and I certainly experience it now, but the image itself is not memory. The remembering refers to something known to be in the past, to what I saw yesterday, not to the image which I call up now. But even when the present image has been set aside as irrelevant, there still remains a distinction between what may be called "intellectual" memory and what may be called "sensational" memory. When I merely know

"that I saw Jones yesterday," this is intellectual memory; my knowledge is of one of these "primitive facts" which we considered in the preceding paragraph. But in the immediate memory of something which has just happened, the thing itself seems to remain in experience, in spite of the fact that it is known to be no longer present. How long this sort of memory may last, I do not profess to know; but it may certainly last long enough to make us conscious of a lapse of time since the thing remembered was present. Thus it would seem that in two different ways past things may form parts of present experience.

The conclusion that past things are experienced in memory may be reinforced by considering the difference between past and future. Through scientific prediction, we may come to know, with greater or less probability, many things about the future, but all these things are *inferred*: not one of them is known immediately. We do not even know immediately what we mean by the word "future": the future is essentially that period of time when the present will be past. "Present" and "past" are given in experience, and "future" is defined in terms of them. The difference between past and future, from the standpoint of theory of knowledge, consists just in the fact that the past is in part experienced now, while the future still lies wholly outside experience.

4. How do we come to know that the group of things now experienced is not all-embracing? This question arises naturally out of what has just been said concerning the future; for our belief that there will be a future is just one of those that take us beyond present experience. It is not, however, one of the most indubitable; we have no very good reason to feel sure that there will be a future, whereas some of the ways in which reality must transcend present experience seem as certain as any knowledge.

This question is one of great importance, since it intro-

duces us to the whole problem of how knowledge can transcend personal experience. For the present, however, we are not concerned with the *whole* of our individual experience, but only with the experience of a given moment. At first sight, it might seem as though the experience of each moment must be a prison for the knowledge of that moment, and as though its boundaries must be the boundaries of our present world. Every word that we now understand must have a meaning which falls within our present experience; we can never point to an object and say: "*This* lies outside my present experience." We cannot know any particular thing unless it is part of present experience; hence it might be inferred that we cannot know that there are particular things which lie outside present experience. To suppose that we can know this, it might be said, is to suppose that we can know what we do not know. On this ground, we may be urged to a modest agnosticism with regard to everything that lies outside our momentary consciousness. Such a view, it is true, is not usually advocated in this extreme form; but the principles of solipsism and of the older empirical philosophy would seem, if rigorously applied, to reduce the knowledge of each moment within the narrow area of that moment's experience.

To this theory there are two complementary replies. The one is empirical, and consists in pointing out that in fact we do know more than the theory supposes; the other is logical, and consists in pointing out a fallacy in the inference which the theory draws from the data. Let us begin with the empirical refutation.

One of the obvious empirical refutations is derived from the knowledge that we have forgotten something. When, for example, we try to recall a person's name, we may be perfectly certain that the name came into our experience in the past, but for all our efforts it will not come

into our present experience. Then again, in more abstract regions we know that there are facts which are not within our present experience; we may remember that there are 144 entries in the multiplication-table, without remembering them all individually; and we may know that there are an infinite number of facts in arithmetic, of which only a finite number are now present to our minds. In both the above cases, we have certainty, but in the one case the thing forgotten did once form part of our experience, while in the other, the fact not experienced is an abstract mathematical fact, not a particular thing existing in time. If we are willing to admit any of the beliefs of daily life, such as that there will be a future, we of course have a great extension of what exists without being experienced. We know by memory that hitherto we have constantly become aware, in sensation, of new particulars not experienced before, and that therefore throughout the past our experience has not been all-embracing. If, then, the present moment is not the last moment in the life of the universe, we must suppose that the future will contain things which we do not now experience. It is no answer to say that, since these things are future, they do not yet form part of the universe; they must, at all times, be included in any complete inventory of the universe, which must enumerate what is to come just as much as what is and what has been. For the above reasons, then, it is certain that the world contains some things not in my experience, and highly probable that it contains a vast number of such things.

It remains to show the logical possibility of the knowledge that there are things which we are not now experiencing. This depends upon the fact that we may know propositions of the form: "There are things having such-and-such a property," even when we do not know of any instance of such things. In the abstract mathematical world, it is very easy to find examples. For instance, we

know that there is no greatest prime number. But of all the prime numbers that we shall have ever thought of, there certainly is a greatest. Hence there are prime numbers greater than any that we shall have ever thought of. But in more concrete realms, the same is true: it is perfectly possible to know that there are things which I have known, but have now forgotten, although it is obviously impossible to give an instance of such things. To recur to our former example, I may perfectly remember that yesterday I knew the name of the lady I was introduced to, although to-day the name is lost to me. That I was told her name, is a fact which I know, and which implies that I knew a particular thing which I no longer know; I know that there was such a particular thing, but I do not know what particular thing it was. To pursue this topic farther would require an account of "knowledge by description," which belongs to a later stage. For the present, I am content to have pointed out that we know that there are things outside present experience and that such knowledge raises no logical difficulty.

5. Why do we regard our present and past experiences as all parts of one experience, namely the experience which we call "ours"? This question must be considered before we can advance to the further question, whether we can know that there are things which transcend the whole of "our" experience. But at our present stage we can only give it a brief preliminary consideration, such as will enable us to speak of one person's total experience with some realization of what we mean and of what are the difficulties involved.

It is obvious that *memory* is what makes us call past experiences "ours." I do not mean that only those experiences that we now remember are considered as ours, but that memory always makes the links in the chain connecting our present with our past. It is not, however,

memory *per se* that does this: it is memory of a certain sort. If we merely remember some external object, the experiencing is in the present, and there is not yet any reason to assume the past experience. It would be logically possible to remember an object which we had never experienced; indeed, it is by no means certain that this does not sometimes occur. We may hear a striking clock, for instance, and become aware that it has already struck several times before we noticed it. Perhaps, in this case, we have really experienced the earlier strokes as they occurred, but we cannot remember to have done so. Thus the case serves to illustrate an important difference, namely the difference between remembering an outside event and remembering our experiencing of the event. Normally, when we remember an event, we also remember our experiencing of it, but the two are different memories, as is shown by the case of the striking clock. The memory which prolongs our personality backwards in time is the memory of our experiencing, not merely of the things which we experienced. When we can remember experiencing something, we include the remembered experiencing with our present experiencing as part of one person's experience. Thus we are led to include also whatever experience we remembered at that earlier period, and so back, hypothetically, to earliest infancy. In the same hypothetical manner, we stretch our personality forward in time to all experiences which will remember our present experiences directly or indirectly.[1] By this extension of the present experience into a series of experiences linked by memory, we include within our own total experience all those particulars, spoken of under our last heading, which are known to have existed, though they do not form part of present

[1] In the language of the logic of relations, if M is the relation "remembering," N the sum of M and its converse, and x is any moment of experience, the total experience to which x belongs is all moments of experience which have to x the relation N*. Cf. *Principia Mathematica*, *90.

experience; and in case time should continue beyond the present moment, we include also those future experiences which will be related to our present as our present is related to our past.

6. What leads us to believe that "our" total experience is not all-embracing? This is the question of solipsism: What reason have we for believing that anything exists or has existed or will exist except what forms part of our total experience in the sense explained in the preceding paragraph?

The logical argument by which we showed that it is *possible* to know of the existence of things that are outside *present* experience applies, without change, to the existence of things that lie outside our *total* experience. Thus the only question we have to consider is whether, as a matter of empirical fact, we know anything which proves the existence of such things. In abstract logical and mathematical regions, it is easy, by means of the very examples which we used before, to *prove* that there are facts which do not form part of our total experience. It seems certain that we shall not think of more than a finite number of arithmetical facts in the course of our lives, and we know that the total number of arithmetical facts is infinite. If this example be thought inconclusive, on the ground that perhaps we survive death and become more interested in arithmetic hereafter, the following example will be found more stubborn. The number of functions of a real variable is infinitely greater than the number of moments of time. Therefore even if we spent all eternity thinking of a new function every instant, or of any finite or small infinite number of new functions every instant, there would still be an infinite number of functions which we should not have thought of, and therefore an infinite number of facts about them which would never enter our experience. It is

therefore certain that there are mathematical facts which do not enter into our total experience.

With regard to existing particulars,, no such cogent argument, so far as I know, can be produced. We naturally suppose that other people's bodies are inhabited by minds more or less like ours, which experience pleasures and pains, desires and aversions, of which we have no direct awareness. But although we naturally suppose this, and although no reason can be alleged for believing that our supposition is mistaken, yet it would seem also that there is no *conclusive* reason for believing it not mistaken. Exactly the same degree of doubt attaches to the inside of the earth, the other side of the moon, and the innumerable physical facts which we habitually assume without the warrant of direct experience. If there is good reason to believe in any of these things, it must be derived from induction and causality by a complicated process which we are not at present in a position to consider. For the present, let us assume as a working hypothesis the existence of other people and of unperceived physical things. From time to time we shall reconsider this hypothesis, and at the end we shall be in a position to sum up the evidence as to its truth. For the present, we must be content with the conclusions: (*a*) that there is no logical reason against it, (*b*) that in the logical world there certainly are facts which we do not experience, (*c*) that the common-sense assumption that there are particulars which we do not experience has been found thoroughly successful as a working hypothesis, and that there is no argument of any sort or kind against it.

The conclusion to which we have been led by the above discussion is that some of the things in the world, but not all, are collected together at any given moment of my conscious life into a group which may be called "my present experience"; that this group embraces things existing now, things that existed in the past, and abstract facts; also that in

my experiencing of a thing, something more than the mere thing is involved, and may be experienced in memory; that thus a total group of my experiences throughout time may be defined by means of memory, but that this group, like the momentary group, certainly does not contain all abstract facts, and appears not to contain all existent particulars, and in especial does not contain the experiencing which we believe to be associated with other people's bodies.

We have now to consider what is the analysis of "experiencing," *i. e.*, what is the bond which combines certain objects into the group forming a momentary experience. And here we must first consider the theory which we have called "neutral monism," due to William James; for the questions raised by this theory are so fundamental that until they are answered, in one way or in another, no further progress can be made.

BERTRAND RUSSELL.

CAMBRIDGE, ENGLAND.

WANG YANG MING, A CHINESE IDEALIST.[1]

TO the philosophic basis of her civilization, more than to any other single factor, is due the survival of China's social institutions and the preservation of her national integrity. The influence of Confucius and Mencius upon Chinese life and thought has been more penetrating and profound than the impress of Greek philosophy upon European life and culture. As in the development of philosophic thought in India interpretation always harks back to the Rig Veda for its authority, so for the philosophic expositions of Chinese philosophers the criterion of orthodoxy is in accord with the Four Books and the Five Classics. This, however, does not exclude the possibility of spirited discussion with reference to the precise connotation of certain classic expressions and the subsequent formation of systems varying as widely as realism and idealism. The object of this essay is to familiarize the reader with one of these systems, the most important one that has appeared in China within the modern period,—that of the philosopher Wang Yang Ming.

The date of Wang Yang Ming's life is approximately 1472-1528. As compared with contemporary European history, he lived in the period of the great maritime discoveries and at the beginning of the Reformation. He was fearlessly propounding his view in China shortly before

[1] Extracts from a paper read before the Royal Asiatic Society, Shanghai, published in this form with permission of the Council. It constitutes a part of the result of two years' research in the Chinese text of the philosophy and letters of Wang Yang Ming.

Giordano Bruno, after a life of restless wandering in search of truth, suffered martyrdom for his philosophic exposition of the universe, and about a century previous to Hobbes, Descartes and Spinoza. The spirit which actuated him was closely akin to that of the Reformation. Thoroughly dissatisfied with what seemed to him useless striving for form and style in literary composition and with the vain discussions of scholars, who ignored the great moral, religious and political issues of his day and gave an incorrect interpretation of the fundamental principles of human life and the universe, he strove to bring the leaders of his people back to the original path of duty outlined in the Four Books and the Five Classics.

At the age of thirty-seven, while serving as a disgraced official, because of the enmity of the eunuch Liu Tsing, in the government despatch service in the province of Kwei-chow, he received his great enlightenment. His biographer describes Lungch'ang where he was stationed as a resort of venomous snakes and poisonous worms, inhabited by babbling barbarians with whom he could not converse. The situation was extremely critical. He feared that at any moment a decree from the capital might order his death. Moreover, his followers all fell ill. Nothing daunted, he chopped wood himself, carried water, and made soft-boiled rice for them, cheering them with songs and stories of home. Also, in view of his own precarious position, he had a sarcophagus made. In the midst of all these difficulties, the chief subject of his meditation was, "What additional methods would a sage adopt under similar circumstances?" At midnight while on his couch, he suddenly realized what the sage meant by "investigating things for the sake of extending knowledge to the utmost." Overjoyed, he unconsciously called out and, getting up, paced the room. "I was wrong," he said, "in looking for fundamental principles in things and affairs. My nature is

sufficient." From that time he was a faithful defender of idealism against the realism of the philosopher Chu, whose commentaries on the classics were considered as an authority at that time.

The philosophy of Wang Yang Ming, the teacher of Yang Ming grotto, is to-day held in high esteem by the Japanese as an ideal statement of the fundamental principles of life and the universe, and has been a profound factor in their moral development during the last hundred years. In China a tide of rising popularity is rapidly bringing it out of obscurity into the forefront. Not as a closet-philosopher but as a military hero, patriot, and reformer-statesman, his ideal was to bring the scholars of his day back to the true learning of the sages. Educated men of his day spent their time in perfecting library style, their one ambition being success in examinations and a high literary degree, that thereby they might gain emolument and fame; but he considered such procedure ethically unsound. For him the greatest thing was not study to become a *Chinshih,* but study to become a sage.[2] His was an attitude of mind that dwelt upon great moral values, and found fullness of life and moral integrity of greater worth than fame and gain. One day while feasting with several of his disciples, he took occasion to lay bare the futility of his day. "We eat and drink," he said, "only in order to nourish the body. The food which has been eaten must be digested. If it collects in the stomach it causes dyspepsia, and how can it then become muscle? Later scholars study extensively and know much, but what they read and know remains undigested. They all have dyspepsia."[3]

[1] *Chinshih* under the old system of literary examinations was a degree corresponding approximately to the European "Doctor of Philosophy." Once attained, honor, influence and position were assured.

[2] The Philosophy of Wang Yang Ming, Book 2, *Yü Lu,* p. 6. All references to the Philosophy of Wang Yang Ming in this paper are to the Chinese

Confusion and display seemed to him to be prominently characteristic of contemporary learning. Failing to function properly in the life process, it wrought havoc wherever it prevailed. He compared the students of his day to a theatre where a hundred different acts are presented. "The players cheer, jest, hop and skip. They emulate one another in cleverness and ingenuity. They laugh in the play and strive for the palm of beauty. On all sides they emulate one another. The people look toward the front and gaze toward the rear, but cannot see it all. Their ears and their eyes are confused; their mental and physical energy is disturbed. Day and night they spend in amusement. They are steeped in it and rest in it as though they were insane. They do not even know what has become of their family property. Under the influence of such scholars, princes and kings are confused and confounded and all their lives devote themselves to vain, useless literary style. They do not know what they say. The learning of the sages is daily left more in the distance and becomes more obscured, while practices are directed toward acquiring honor and gain. The farther they go the more they fall into error. Though some of them have been deceived by Buddhism and Taoism, yet even the sayings of Gautama and Lao Tze are unable to influence permanently the mind that is devoted to honor and gain."[4]

In order to appreciate Wang Yang Ming's point of view, it is necessary to keep this steadily in mind, for his interest was that of a reformer and thus largely ethical. He attempted to place learning and conduct upon a firm basis. The glamour of a superficial philosophic foundation had no fascination for a man of his practical bent of mind. He sought bed-rock; he wished to find the very source of life and the universe. After having sought vainly in Bud-

edition of his work,—the only one available. While they are not of general interest, they will serve to locate the references for such as read Chinese.

[4] The Philosophy of Wang Yang Ming, Book 3, p. 71.

dhism and Taoism for relief; after having tried the philosopher Chu's instructions to search for principles in external things, but without success; at last in the middle of the night while among the barbarians in far Kwei Chow he came to a state of realization. It was as though the fog had suddenly cleared away. "My nature is sufficient," he said. Upon this foundation the whole structure of his ontology, cosmology, and ethics rests.

What does Wang Yang Ming mean when he speaks of nature? He discusses it in a somewhat fragmentary manner a number of times both in his discourses and in his letters, so that by bringing together the principal ideas involved we are able to get an approximate idea of what his conception includes. Luh Ch'en, one of his disciples, asked him the question, "Are the feelings of commiseration, shame, dislike, modesty, complaisance, approval, and disapproval to be considered nature manifesting virtue?" To this Wang Yang Ming replied: "There is only one nature and no other. Referring to its form and substance, it is Heaven; considered as ruler or lord, it is Shang-ti (God); viewed as functioning, it is fate; as given to men, it is disposition; and as controlling the person, it is mind; manifested by mind, it is called filial piety when it meets parents, and loyalty when it meets the prince. Proceeding from this on, it is inexhaustible, but it is all one nature. Man should use his energy on his nature. If he is able to understand the connotation of the word 'nature,' he will be able to distinguish ten thousand principles."[5] A careful perusal of this makes it evident that this subtle something which Wang designates "nature" is so profound, so rich, so all-inclusive, that viewed as a whole the absolutist would probably greet it as his old friend the absolute, even though it be in Chinese garb. At another time Wang Yang Ming said: "Heaven and earth are one structure with me; spirits

[5] *Ibid.*, Book 1, p. 26.

and gods are in one all-pervading unity with me."[6] It is, under such circumstances, reasonable to suppose that the discussions of nature by men of the past would be various. "There were those," he said, "that discussed it from the point of its underlying substance; there were those that based their discussions on its manifestations; there were those that proceeded from its source; there were those that proceeded from the point of its defects and corruptions. Taking it all together, they all referred to this one nature, but there were degrees of depth in what they saw."[7]

Thus far, however, the discussion emphasizes the profundity, abstruseness, comprehensiveness, and wealth of manifestation of nature in a very general way, but fails to point out accurately its fundamental character. Intelligence appears to be of prime importance. But is it really so, or is it perhaps only a by-product, while mechanism is basal? Wang does not fail to elucidate this point. "There is one nature," he asserts, "and that is all. Charity, righteousness, propriety, and wisdom are *ab initio* characteristic of it; quick apprehension, clear discrimination, far-reaching intelligence, and all-embracing knowledge are native to it. Pleasure, anger, sorrow, and joy are the feelings of this nature."[8] Of its qualities of character, benevolence, which the sages have designated as the highest virtue, is the principle of continuous creating and growth. This principle is boundless in extent and everywhere present, but in its process and manifestation it advances gradually.[9]

However, it was in men's mind that he primarily was interested. "My own nature is sufficient,"[10] he said when he came to a state of realization. If nature at large be designated as the macrocosm, then human nature is the micro-

[6] *Ibid.*, Book 2, p. 26.
[7] *Ibid.*, Book 2, p. 31.
[8] *Ibid.*, Book 3, p. 20.
[9] *Ibid.*, Book 1, p. 37.
[10] *Ibid.*, Biography, p. 8.

cosm, and for him human nature was the human mind. He was taking recreation at Nan Ch'en when one of his friends pointed to the flowers and trees on a cliff and said, "You say that there is nothing under heaven outside the mind. What relation to my mind have these flowers and trees on the high mountain, which blossom and drop of themselves?" Wang replied: "When you cease regarding these flowers, they become quiet with your mind. When you see them, their colors at once become clear. From this you can know that these flowers are not external to your mind."[11] This is undisguised idealism in which the microcosm creates as truly as the macrocosm. In the great all-pervading unity the most differentiated, highly specialized portion is the human mind. It manifests the only creative activity that men can really know. It is self-sufficient and embraces the universe. He said again and again that the mind of man is *ab initio* law, that it is the embodiment of the principles of Heaven. Thus its very essence is natural law, though not in any partial, superficial sense. There are no other principles operative any where, for the mind is so all-embracing that it has no within and without.[12]

Chiu Ch'uan had great difficulty in comprehending Wang's explanation of things, for from his common-sense point of view things were external. He questioned his teacher's position that a thing is identical with the presence of an idea. "Since things are external," he said, "how can they be one with the person, the mind, purpose and knowledge?" To which the teacher replied: "The ears, eyes, mouth, nose and four members constitute the person, or body; yet without the mind how can the person see, hear, speak, or move? On the other hand, if the mind wishes to see, hear, speak, or move, it is unable to do so without the use of ears, eyes, mouth, nose, and the four

[11] *Ibid.*, Book, 2, p. 17. [12] *Ibid.*, Book 2, p. 4.

members. From this it follows that if there is no mind, there is no person, or body, and that if there is no person, or body, there is no mind. If one refers only to the place it occupies, it is called person, or body; if one refers to the matter of control, it is called mind; if one refers to the activities of the mind, it is called purpose; if one refers to the intelligence of the purpose, it is called understanding; if one refers to the relations (implications) of the purpose, it is called things."[13] From this it is evident that from Wang Yang Ming's point of view the volitional activity of the mind is true creative activity. In case the purpose is used with reference to the flowers growing on the side of the mountain precipice, then these flowers are a thing. Take away the purpose and *ipso facto* the flowers are no more. "When the purpose is used with reference to serving one's parents, then serving one's parents must be considered a thing. If it is used with reference to governing the people, then governing the people must be considered a thing. When the purpose is used in study, then study must be considered a thing; and when it is used in hearing litigation then this is a thing. Wherever the purpose is applied, there some definite thing is present. If there is a particular purpose, there is a particular thing present corresponding to it; and without this particular purpose the particular thing is lacking. Is not then," Wang asked, "a thing identical with the functioning of the purpose?"[14]

These, in brief, are the fundamental principles of his metaphysics. That he considered volitional activity as basal is evident, but will be more so as epistemological and ethical phases of his system are discussed.

* * *

For Wang Yang Ming the epistemological problem centered primarily about the question of investigating things for the avowed purpose of extending knowledge to

[13] *Ibid.*, Book 2, p. 2.

[14] *Ibid.*, Book 3, p. 58.

the utmost. Readers of the Chinese classics will recognize that this idea is mentioned in the Great Learning in the introductory text of Confucius. The difficulty lies not so much in the words themselves, for these seem clear enough, but in their correct interpretation. Like the oracles of Apollo at Delphi, a closer examination shows them to have an obscure, ingeniously ambiguous connotation. The question is: What does "investigation of things for the purpose of extending knowledge to the utmost" imply?

The philosopher Chu in his commentary on the fifth chapter of the Great Learning had said: "If we wish to carry our knowledge to the utmost we must investigate the principles of all things with which we come into contact."[15] Since one of the necessary qualifications of a sage is just this, that he have extended his knowledge to the utmost, it was but natural that Wang, whose one ambition was to become a sage, should attempt to carry this out into practice. He chose as his point of departure the more manifest interpretation of the philosopher Chu, and tried to follow out the instructions therein given. He and his friend Ch'ien discussed the possibility of investigating everything under heaven. Pointing to a bamboo in front of the pavilion, he told Ch'ien to investigate it. Both day and night Ch'ien worked at the task and after three days he was physically and mentally so exhausted that he took sick. Wang feared that this was solely due to lack of strength and energy, and himself undertook to carry on the investigation. Though he worked day and night he, too, was unable to understand the principles of the bamboo, and after seven days became ill from over-exertion. Discouraged, both Ch'ien and he gave up. "We can become neither sages nor virtuous men," they said, "for we lack the great strength required to carry on the investigation of things.[16]

[15] The Great Learning, Chap. 5.

[16] The Philosophy of Wang Yang Ming, Book 2, p. 22.

Not until his enlightenment while at Lungch'ang did he realize the futility of attempting thus to investigate the things under heaven. There had been sages in the past, this he knew. From his own experience he saw that a thorough investigation of so commonplace a thing as a bamboo was not possible. How much less the investigation of all things! From now on his task was that of expounding a better way.

Relief was found in adopting the view that knowledge can be extended to the utmost only by a thorough devotion to nature. If the principles of things and affairs are to be exhaustively investigated, and thereby knowledge completed, it must be as a result of understanding and developing the mind. Not things without, but mind itself, offers the solution. The point of departure is the intuitive faculty or, in other words, nature itself. "This seeking for fundamental principles in things and affairs," said he, "is exemplified in seeking the principle of filial piety in one's parents. In case a person seeks the principle of filial piety in the parents, is it then in his own mind or is it in the person of the parents? In case it is in the person of the parents, is it then true that after the parents are dead, the mind lacks the principle of filial piety? If one sees a child fall into a well, there must be commiseration. Is this principle of commiseration in the child, or is it found in the intuitive faculty of the mind? Whether the individual is unable to follow the child and rescue it from the well or seizes it with his hand and saves it, this principle is involved. Is it then in the person of the child or is it rather in the intuitive faculty of the mind?"[17] At another time he discussed this matter with Liang Jih Fu. "Tell me," he said, "what is meant by a thorough investigation of the principles of events and things?" Liang replied: "It would imply that in caring for one's parents one must thoroughly investigate

[17] *Ibid.*, Book, 3, p. 54.

the principles of filial piety, or in serving one's prince one must thoroughly investigate the principles of loyalty." Thereupon Wang said: "Are the principles of loyalty and filial piety to be investigated on the bodies of the prince and parents, or in one's own mind? If they are to be investigated in the mind, that would imply a thorough investigation of the principles of the mind."[18]

The problem of knowledge must be solved by depending upon the intuitive faculty and developing it. The development of knowledge refers to the development of intuitive knowledge, for the field of knowledge and the field of intuitive knowledge are conterminous. In so far as the intuitive faculty remains undeveloped, knowledge is undeveloped; and in so far as it is developed, the individual has knowledge of things and affairs. Intuitive knowledge does not come from seeing and hearing, though sense-perception is itself a function of the intuitive faculty. Apart from it there is no knowledge.[19] It knows without cogitation, and is able to act without learning.[20] Wang praises it as being absolutely perfect. When Chiu Ch'uan asked him about the method of extending knowledge, he said: "The intuitive faculty is your standard. If your thoughts are right it is aware of it, and if they are wrong it also knows it. You must not blind it nor impose upon it, but must truly follow its lead. Whatever is good should be cherished; whatever is evil should be discarded. What confidence and joy there is in this! This is the true secret of the investigation of things and the real method of extending knowledge to the utmost. If you do not depend upon these true secrets, how will you engage in an investigation of things? I, too, have appreciated only in the past few years that it is to be thus explained. At first I doubted that a simple obedience to the intuitive faculty

[18] *Ibid.*, Book 1, p. 49. [19] *Ibid.*, Book 3, p. 42.
[20] *Ibid.*, Book 3, p. 46.

would be sufficient. When I had very carefully examined it, I found that it has no deficiency whatsoever."[21]

The ethics of Wang Yang Ming's system is also firmly lodged in his exposition of the intuitive faculty, which he considers is the point of clearness that natural law attains in its moral aspects. For this reason intuitive knowledge of good is to be identified with moral principles. The intuitive faculty is tranquil; it is the equilibrium in which there is no stirring of the feelings. He who would understand the path of duty must exercise this faculty, for it alone marks clearly the path of duty. He who would choose the right and expel the evil must make use of it, for there is nothing in the categories of right and wrong that it does not naturally know. The highest good is simply the development of the intuitive faculty to the utmost. The finished product is a sage. "All-embracing and vast, he is like heaven; deep and active like a fountain, he is like the abyss."[22] Serving his fellow-men and regulating his passion-nature, he is actuated by the desire to be a man who in his eager and unceasing pursuit of knowledge forgets his food. Forgetting his sorrow in the joy of the attainment of knowledge, he is never distressed. With reference to the principles of Heaven he is both omniscient and omnipotent.[23] Completely dominated by moral principles and wholly unhampered by passion, his integrity and moral worth are of the quality of the finest gold. The capacity may vary from man to man, but the quality is always of the highest and purest type.[24]

A deaf and dumb man, Yang Mao by name, visited Wang Yang Ming, who conferred with him by means of writing. The ensuing conversation, which may well serve

[21] *Ibid.*, Book 2, pp. 4 and 5.

[22] Doctrine of the Mean, Chap. 31, § 3.

[23] Philosophy of Wang Yang Ming, Book 2, p. 8.

[24] *Ibid.*, Book 1, pp. 40f.

to exemplify his method of dealing with the ethical problem, was as follows:[25]

Wang Yang Ming said: "You are unable to speak or discuss either that which is right or that which is wrong. You cannot hear that which is right nor that which is wrong. Is your mind still able to distinguish right from wrong?"

Mao replied: "I know right and wrong."

"In that case," said Wang, "though your mouth is different from that of other men, and your ears are not like other men's ears, yet your mind is like that of other men."

Mao replied in the affirmative by nodding his head and thanking with his hands.

"In man," wrote Wang, "the mind alone is important. If it cherishes the principles of Heaven, it is the mind of sages and virtuous men. In that case, though the mouth cannot speak and the ears cannot hear, it is only sageness and virtue that cannot speak or hear. If on the other hand the mind does not cherish the principles of Heaven, it is the mind of birds and animals. Though under such circumstances there were the power of speech and audition, yet it would be merely an instance of a speaking and hearing bird or animal."

Mao struck his breast and pointed toward heaven.

Wang said: "Toward your parents you should exhaust the filial piety of your mind; toward your elder brother, its respectfulness; toward your village clan, your neighbors, your kindred and your relatives, its complaisance, harmony, respectfulness, and docility. When you see others prosperous, you should not covet their wealth and advantage. Within yourself you should practice that which is right and not that which is wrong. It is really not necessary that you should hear it when others say that you are

[25] *Ibid.*, Book 4, pp. 83 and 84.

right, nor do you need to hear it when they speak of your mistakes."

Mao nodded his head and bowed in thanks.

"Since you are unable to discuss or hear right or wrong, you are saved the necessity of making distinctions between a great deal of idle, useless right and wrong. The discussion of truth and error begets truth and error and brings forth trouble and vexation. By hearing good and evil one adds to one's right and wrong and to one's troubles. Since you cannot speak or hear, you are spared a good deal of useless good and evil, as well as much trouble and vexation. You are much more cheerful, happy, and self-possessed than others."

Mao struck his breast, pointed toward heaven, and replaced his feet on the ground.

Thereupon Wang said: "My instruction to you to-day is that it is only necessary to act in accordance with your mind and not necessary to speak; that it is only necessary that you comply with your mind and not necessary to hear."

Mao prostrated himself, saluted, and departed.

In its practical aspects, Wang's ethical system places special emphasis upon action as the *sine qua non* of moral progress. Knowledge and action, theory and practice, are so interrelated that the former does not exist without the latter. Nature can be developed only as the individual directly applies what he knows. In case he fails to act, the knowledge that he supposes himself to have has not really been acquired. Here Wang is not far from pragmatism, which urges that the truth of an idea consists in its verifiability. As Paul S. Reinsch has stated in *Intellectual and Political Currents in the Far East* (page 138), this phase of his philosophy has doubtless had a profound influence upon students in Japan and China.

The absolute moral perfection of the intuitive faculty presented a serious problem to some of Wang's disciples.

That the main divisions of the doctrine and the general direction of the path of duty could be readily understood in this way seemed clear to them; but with regard to changeable sections and paragraphs and the details of conduct under changing circumstances, they felt considerable apprehension. Is the intuitive faculty really able to mediate reliable knowledge in such cases, or is it necessary for a person to seek earnestly for what is right and wrong in things themselves? Is knowledge of right and wrong innate, or is it acquired from experience? In a letter to his teacher, Ku Tang Ch'iao urges that when one reaches the facts that Shun married without informing his parents,[26] that Wu put troops into the field before he buried his father, that the son endures the small stick but evades the large one, that he cuts flesh from his thigh to feed his ill parent, that he erects a straw hut beside the grave of his parent, or any similar thing, then the knowledge mediated by the intuitive faculty is inadequate and a person must depend upon his experience.[27] Wang considered this position incorrect, for he felt that the intuitive faculty has the same relation to the details of right and wrong and to changing circumstances as compasses and squares have to squares and circles, and measures to length and breadth. "The changes in circumstances relative to details," he said, "cannot be determined beforehand, just as the size of the square or the circle, and length and breadth, cannot be perfectly estimated. But when compasses and squares have been set, there can be no deception about the size of the square or the circle, and when rule and measure have been fixed there can be no deception about length or shortness. When the intuitive faculty has been completely developed there can be no deception regarding its application to changing details. As for Shun's marrying without tell-

[26] Shun and Wu were two famous emperors of ancient China.

[27] Philosophy of Wang Yang Ming, Book 3, p. 61.

ing his parents, was there any one previous to his time who served as an example of such a deed? In what historical and mythological document did he find a precedent, or of what individual did he make inquiry? Or did he rather make use of the intuitive faculty to consider what should be done, and there being no other way act thus?"[28] What is true in this instance Wang taught as true in all others. From his point of view the intuitive faculty is quite competent to grapple with any moral problem whatsoever.

Last, but not least, is the problem of evil. No system of philosophy is complete without having attempted a solution for this perennial problem, and more than one system has suffered shipwreck in the attempt. Wang also was unable to disregard it. Hsieh K'an, one of his favorite disciples, was pulling grass out from among the flowers. "How difficult it is," he said, "to cultivate the good in Heaven and on earth, and how hard it is to get rid of the evil!" Wang said, "You should neither cultivate the good nor expel the evil." A little later he continued, "This way of viewing good and evil has its source in the body and thus is open to mistakes." As Hsieh K'an was not able to comprehend, he added: "The purpose of Heaven and earth in bringing forth is even as in the instance of flowers and grass. In what does it distinguish between good and evil? If you, my disciple, take pleasure in seeing the flowers, then you will consider flowers good and grass bad. If you wish to use the grass you will, in turn, consider the grass good." Hsieh K'an replied, "In that case there is neither good nor evil, is there?" Wang answered, "The tranquility of the principles of Heaven is a state in which there is neither good nor evil, while the stirring of the passion-nature is a state in which there is both good and evil."[29]

For him there was only one real evil, and that consisted

[28] *Ibid.*, Book 3, pp. 61f.

[29] *Ibid.*, Book 1, pp. 42f.

in exceeding or failing to realize nature. All other distinctions between good and evil seemed to him to savor of arbitrariness and superficiality. The mind is by nature clear and bright and the intuitive faculty, if given free play, will develop to the utmost. Selfish desire and ceremoniousness are things that obscure it and obstruct its smooth functioning. If the mind in its natural condition is like a clear bright mirror, then selfish desires and deeds are the dust and spots that darken it and hinder it from reflecting clearly. The mind of the sage allows no obscuration to take place, but the mind of the ordinary man is subject to all the evils that inhere in the selfish striving for gain and fame.[30]

As a remedy for evil he advocated that all obscuration be removed from the mind and every obstruction be taken away, so that it can function normally. To this end the determination must be fixed and the purpose made sincere. The mind must continually cherish the principles of Heaven, for so long as it does this it is proceeding along the line of nature. If the individual fails at the point of making and keeping his purpose sincere, no amount of striving to understand so-called external things will keep the evil from sprouting, for this striving is itself a token of selfishness. By removing all obscuration and every obstruction of selfishness, passion, pride and ceremoniousness from the intuitive faculty, it is given perfect freedom to develop naturally and normally. The teacher spoke to his disciples saying, "Sirs, in your task of developing the mind, you must not in the least hinder or force the development. The student cannot leap over into the principles of the sage. Rising, falling, advancing, receding, are naturally the order of the task."[31] However, in all this the determi-

[30] *Ibid.*, Book 4, p. 5.

[31] *Ibid.*, Book 2, p. 12.

nation must be fixed and the purpose sincere.[32] There must be absolute devotion to the intuitive faculty and unfailing loyalty to nature. "Without sincerity there can be nothing."[33]

FREDERICK G. HENKE.
WILLAMETTE UNIVERSITY, SALEM, OREGON.

[32] *Ibid.*, Book 1, p. 56f.
[33] Doctrine of the Mean, Chap. 25, § 2.

CHRISTIAN ELEMENTS IN LATER KRISHNAISM AND IN OTHER HINDUISTIC SECTS.*

KRISHNA AND CHRIST.

WE are treading on solid ground when, in the question of Christian contributions, we turn to that particular phase of Krishnaism which we meet in the literature of the Purânas, of works similar to the Purânas and of writings intrinsically connected with the Purânas.

Of all Indian religions Krishnaism (as Hopkins correctly observes)[1] was by its nature most easily accessible to Christian influences. Buddhism, at least in its original form, was a religion which recognized neither God nor soul; Shivaism places greatest weight upon rites and self-mortification, whereas Krishnaism in its popular form is a religion of joy; it rejects bloody sacrifice and preaches love. To these fundamental features of Indian religions which Hopkins has emphasized, we might add that Jainism also, which is so closely allied to Buddhism and which has continued in India to the present day, possesses no similarity to Christianity in its religious character. On the other hand there exists between Christianity and Krishnaism an intrinsic relationship which explains the susceptibility of the latter to Christian influences. To this intrinsic

* Authorized translation from the German manuscript by Lydia G. Robinson. In the bibliographical references the following abbreviations will be observed: ERE, *Encyclopædia of Religion and Ethics*; IA, *Indian Antiquary*; JAOS, *Journal of the American Oriental Society*; JRAS, *Journal of the Royal Asiatic Society*.

[1] *India Old and New*, 162.

relationship may be added an external reason to which attention has often been called, namely, that the similarity of the names Christ and Krishna, which is often in evidence to-day in the religious conversations and writings of Indians, has certainly facilitated the adoption of Christian features. In some localities of India the word Krishna is pronounced Krishta.[2]

THE GOD'S BIRTHDAY.

I shall begin with an element of the worship which in all probability is the oldest Christian possession in Krishnaism and moreover renders it possible to recognize Christian influence with such distinctness that it supplies an appropriate basis for the investigation of the other effects of Christianity upon Hinduism. This element is the celebration of Krishna's birthday concerning which we have the learned and circumstantial—I might say the too detailed—treatise of A. Weber,[3] the main results of which are unassailable, although in some particulars it is not quite correct.

We have seen above[4] that the conception of Krishna as a divine child which has contributed so much to the spread of Krishnaism all over India is autochthonous. The celebration of Krishna's birthday, however, is an imitation of the Christian festival. Weber[5] describes twelve texts, which he dated from the thirteenth century on, in which the Janmâstamî (Krishna's birthday), or a variant of it bearing the name Jayantî, is treated in more or less detail;

[2] Grierson, JRAS, 1907, 316.

[3] On the Krishnajanmâshtami (Krishnas Geburtsfest) in the *Abhandlungen der K. Akademie der Wiss. zu Berlin*, 1867, 217ff. The earlier literature on the question of the connection between Christian and Krishnaistic legends which has been so much discussed since the middle of the eighteenth century is mentioned on pages 3-10ff. Cf. also Hopkins, *Religions of India*, 430ff.; *India Old and New*, 162ff.

[4] See "Christian Elements in the Mahâbhârata," *The Monist*, July, 1913, pp. 343ff.

[5] *Op. cit.*, 218ff.

and adds, what is more important historically, a list of the Purânas which mention the festival and of the Purâna passages quoted.[6] From this we learn that almost all the Purânas contain such mention[7] and that most of all the Bhavishya and Bhavishyottara-Purâna come into consideration,[8] according to which Krishna himself is said to have established the festival as soon as he had slain Kamsa, and indeed in the midst of universal jubilation for all castes, even for the Shûdras.[9]

When from the quotations out of the Purânas, Weber[10] explains the Krishna festival to be positively authenticated for about the eleventh century, this late date rests upon the low estimate of the age of the Purânas which was generally prevalent among Sanskritists at the time when Weber's treatise appeared (1867) and still later. Nevertheless Weber at once adds this sentence: *"The unanimity of so many works* of this kind in the meantime may lead us considerably farther upwards, since such a *universal* recognition of the festival indeed demands the conclusion that at the time of their composition it was generally accepted, whereupon *eo ipso,* the farther assumption naturally follows that its *adoption* or *introduction* goes back to a *still earlier* time." This "earlier time" he seeks to determine more exactly by succeeding passages, always under the spell of his conviction that Christian influences had penetrated to India from Alexandria in Egypt.[11]

[6] *Ibid.*, 221ff., especially 239. The quotations from the Smriti are rather unimportant since these versified texts are "modern compilations of secondary significance" in spite of the ancient names Parâshara, Paithinasi, Bhrigu, Vasishtha, Vishnu, Vyâsa. See Jolly, *Recht und Sitte,* 24.

[7] Strangely enough not the Bhâgavata-Purâna in spite of its sectarian Krishna character which is especially distinct in the tenth book. To be sure it describes in detail the time of Krishna's birth (10, 3, 1-8) but says nothing of the festival. This must certainly have a definite reason which according to Weber (page 241) may be sought in the fact that "in the Bhâg. Pur. we have the modern interpretation of the worship of Krishna which is occupied mainly with the *love affairs* of Krishna and in which the *mother* of God withdraws more and more into the background."

[8] Weber, 242ff. [9] *Ibid.*, 248. [10] *Ibid.*, p. 240.

[11] Compare *The Monist,* July, 1913, p. 324.

Weber starts from the fact that Christ's birthday has been celebrated in the Christian church since the middle of the fourth century and that in Alexandria a festival of the birth of Christ existed in connection with that of his baptism on January 6, which "was supplanted shortly before the year 431 by an independent and exclusive celebration of the Christmas festival on December 25."[12] Now because the naming of Krishna forms an integral part of the celebration of his birth, it seems to Weber extremely obvious that the Hindus adopted the festival in the period "during which that peculiarly Egyptian custom, to celebrate the birth of Christ *at the same time* as his *baptism* on January 6, prevailed, i. e., in the time between the *second* half of the *fourth century and the year* 431 when the celebration of the *birth alone* on December 25 replaced it."

It is clear that this conjecture of Weber's and the reason for it stand upon a weak foundation. But J. Kennedy is mistaken when he says[13] that "Weber's chief arguments are drawn from the history of the legends regarding the Virgin and the representations of the *Madonna lactans;* on this basis he assigns the period 350-431 A. D. as the period to which the rise of the Krishna festival must be assigned," and when he opposes this alleged proof of Weber's with the words: "The legends of the Madonna were not known in Egypt until towards the close of the fifth century, and were probably derived from Italy," etc. Weber's main arguments for assigning the date 350 to 431 are in no wise founded upon the legends of the Madonna and her earliest representations with the Christ-child; he expressly characterizes these legends and pictures[14] as only a part of the material to be taken into consideration for the whole of the investigation; instead he has based the date 350-431 solely upon the reasons I have just cited. Hence Kennedy has here been guilty of hastiness.

[12] *Kr. Geburtsfest,* 337. [13] JRAS, 1907, 483. [14] *Kr. Geburtsfest,* 336.

In reality Weber's attempt to supply a date fails for the reason that Alexandria can not be taken into consideration as a medium of Christian transmissions, because by the beginning of the third century it has already lost its significance for the commerce of the world and especially for direct intercourse with India. Moreover, Christianity could not from a remote distance have exercised so strong an influence as is noticeable in Krishnaism. For this, direct contact was requisite. Weber also surrenders his date at once[15] and goes down to the year 640 as a date which would harmonize particularly well with the conclusions drawn from the age of the texts describing the birth festival of Krishna, or from their place in the history of literature. As is shown from an earlier passage,[16] Weber considers the year 640 as the *terminus ad quem,* because in that year Alexandria had been captured by the Moslems. Here again therefore we have Alexandria as the basis for argument.

Although Weber's *argument* in favor of the time shortly before 640 is untenable, yet this date agrees remarkably with the one which we must admit for a different reason. We have proof that the first Nestorian mission into central north India took place in the year 639;[17] and since there is no doubt that the Christmas festival and other Christian elements had been brought by the Nestorians into that region, that is, into the home of Krishnaism, the time (the first half of the seventh century) agrees very well with the age of the Purânas which are our earliest sources for the observance of Krishna's birthday. In this period, accordingly, occur the earliest Christian influences on Brahmanism, if we disregard the remote suggestion about the Christian religion which seems to be present perhaps a century earlier in the Shvetadvîpa legend of the Mahâbhârata.

[15] *Op. cit.*, 338. [16] *Ibid.*, 323.

[17] "Contributions of Christianity to Buddhism, *Monist*, April, 1912, p. 179.

Before I enter upon the details of the Krishna festival, the fact deserves mention that the *season* in which this festival was and still is celebrated in India does not belong to loans from Christianity. The birthday of Christ was at first set for January 5th or 6th, March 28, April 19-20, May 20, November 19, and not until later for December 25; on the other hand Krishna's birth festival according to our sources was celebrated on different days, to be sure, yet always in the period between June and September.[18] Whether we have here a reminiscence of the actual time of Krishna's birth must remain unsolved.

The celebration of the birth festival does not pertain to Krishna alone but also to his mother Devakî, and he is represented as lying upon her breast in unmistakable imitation of Christian pictures of the *Madonna lactans*. The question with regard to the earliest appearance of Christian pictures of this kind, to which Weber[19] gives detailed attention, does not concern us here. For our purpose it is enough to know that the veneration of Mary and the representation of the Virgin and Child were current since the beginning of the Nestorian controversies in the fifth century.[20] Christian influence upon the Krishna festival is further very distinctly betrayed by the fact that in it the scene of the ancient Krishna legend—according to which Krishna was born in prison under circumstances of poverty and danger and was made away with in great haste and rescued by his father—appears in a completely altered form. The place of Krishna's birth has become a peaceful cattle stall (*gokula*) in which form for the festive purpose a confinement home (*sûtikâgriha*) is set up and is fitted out with a picture of the mother lying upon a bed with the divine child at her breast, and also with paintings or

[18] Weber, *Kr. Geburtsfest*, 338, Note 1.

[19] *Ibid.*, 324ff.

[20] In spite of Kennedy, JRAS, 1907, 483, 484.

sculptured representations of Krishna's father, of shepherds and shepherdesses, cattle, asses, etc., including all sorts of deities and demigods in the air.[21] Hence exactly the same as the scene among the shepherds after the birth of the Saviour is represented in Christianity for purposes of edification.

After the manger is set up and adorned as just described, the Krishna festival itself begins with the supplication and worship of the holy family at which many kinds of vegetable offerings are made, and the invocation of the mother of God (*devamâtar*) plays an important part.[22] The result of the whole festival is that the Christian stories of the birth of Jesus are widely known in their Indian garb among the Hindus down to the present day, even if otherwise they know nothing of Christianity.

PARALLEL MIRACLES.

In addition to the birth celebration, other features of the Christian legend have entered into the history of Krishna's childhood and later life. Here belong the tales of the Vishnupurâna, that the shepherd Nanda, the fosterfather of Krishna, was journeying by wagon at the time of the latter's birth with his pregnant wife Yashodâ to Mathurâ *to pay his taxes* (cf. Luke ii. 4, 5),[23] and that Krishna shortly before his entry into Mathurâ received a box of ointment from the crippled Kubjâ and as a reward healed

[21] Weber, *op. cit.*, 248, 252, 272, 273, 280, 281.

[22] *Ibid.*, 284, 310.

[23] *Ibid.*, 338. Shortly before, Weber erroneously cites as Indian texts in which these loans exist, besides the Purânas and the Jaiminibhârata, the Harivamsha also and "some interpolated passages of the Mahâbhârata." The Mahâbhârata (according to Weber, 318, Note 5) treats Krishna's miracles in his childhood and youth in only *one* passage belonging to the latest interpolations (II, 1436-1445). Nevertheless, one who consults the text will not find there any parallel with Christian tales. Hopkins in *India Old and New*, at the bottom of page 165, has obviously made use of the above mentioned statement of Weber. But when he observes that in that passage of the Mahâbhârata the only deed of the *child* Krishna that is mentioned is the killing of a hawk, that is not correct; for in verse 1440 it is also mentioned that the babe overturns a loaded wagon.

the donor of her infirmity.[24] In this second story which is wrongly assigned by Weber[25] to no earlier source than the Jaiminibhârata, two or three familiar stories from the New Testament seem to be combined.[26] Krishna performed the cure by touching the crippled girl with his thumb and two other fingers on the chin, by lifting her head high while at the same time he pressed down her feet with his feet and so pulled her straight.[27]

With these tales belong the following which Weber has brought forward from the Jaiminibhârata, a Krishnaistic work of Purâna character, of whose age we can only say that it must have been composed before the beginning of the thirteenth century because at that time it was translated into Canarese.[28] The legend there given of the raising of the dead son of Duhshalâ by Krishna must be referred to Christian influence, because the older form of the story of Duhshalâ as it appears in the Mahâbhârata, XIV, 2275-2297, knows nothing of the awakening of the son.[29] Christian influence is at least very probable, because such things are not related of Krishna in the older sources, and in part it is certain in the accounts of Krishna's feeding large throngs of ascetics by a single vegetable leaf left

[24] Vishnupurâna, 5, 20. Kubjâ means "the deformed one"; the proper name according to the Vishnupurâna is Naikavakrâ, "She who is crippled in different places"; according to the Bhâgavata Purâna, 10, 42, 3, where the story is told in a similar fashion, Trivakrâ, "She who is crippled in three parts of the body" (back, breast and hips, according to Shrîdhara's commentary). Cf. Vishnupurâna, translated by H. H. Wilson, edited by Fitzedward Hall, Vol. V, p. 21 note.

[25] *Kr. Geburtsfest,* 339.

[26] Matt. xv. 30, 31; ix. 20ff. (Mark v. 25ff.; Luke viii. 43ff.); Luke vii. 37, 38.

[27] J. Kennedy, JRAS, 1907, 978, note 2, says: "The manner in which Krishna pulls the unguent-maker straight is exactly the way in which the youthful Christ makes two pieces of wood equal by pulling them out to the same length (Pseudo-Matthew, c. 37)." But here to be sure two very different things are made parallel.

[28] "Ueber eine Episode im Jaimini-Bhârata," *Monatsber. d. K. Preuss. Akad. d. Wiss. zu Berlin,* 1869, 12, *Note* 3; 34ff. The loans from Christianity, assumed by Weber, are to be found in the passages of the Jaiminibhârata. See pp. 37, 38.

[29] Weber, *Kr. Geburtsfest,* 315, Note 1; 318, Note 5; 339. *Indische Streifen,* II, 392, Note 2.

over in the corner of a pot; of the woman with an issue of blood who came to his feet seeking to be healed; of touching his foot as a means to avoid death; of his coming at once to bring help as soon as he is prayerfully besought; of the wish of a pious man not to die before he has seen him; and of the sin-redeeming power which Krishna's glance (or aspect), or the thought of him, or merely naming his name is supposed to have. The idea of the healing power of the water he washed in is at all events a transmission from an apocryphal Gospel.[30]

Thus far can we go with Weber. But we have shown above[31] that he is mistaken when he explains the narrative of Kamsa's persecutions and slaughter of children in this connection as a loan from Christianity. A similar judgment is to be passed upon what Weber says directly afterwards "of the carrying across the river (Christophoros)" without giving any explanation or proof of it. Hopkins[32] simply says it after him: "We find too in the history of Krishna the late Christophoros legend," and yet here, where we must reflect as to what after all Weber meant, an investigation would have been in place. Weber can not very well have had anything else in mind than that feature of the legend which treats of the rescue of the newly born Krishna whom his father Vasudeva carries across the Yamunâ in order to bring him to the shepherdess Yashodâ and to exchange him for her newly born daughter.[33] That on this occasion Vasudeva is obliged to ford the Yamunâ which readily lets him pass through its waters, accordingly, is the only ground upon which Weber here bases a transmission of the legend of St. Christopher! The pictorial representa-

[30] Weber (339, Note 2) refers to a passage in the Arabian Gospel of the Infancy.

[31] See *Monist*, July, 1913, p. 347.

[32] *India Old and New*, 166.

[33] Cf. the contents of Harivamsha in *The Monist*, July, 1913, p. 346, and Weber, *Kr. Geburtsfest*, 251 note.

tion of the scene on the accompanying plate should have served as a warning against such a hasty statement. A newly born child whom his father is rescuing from certain death by a hasty removal and exchange is certainly something very different from a boy placed upon the shoulders of a gigantic ferryman. I have previously shown[34] that the Christopher legend belongs in an entirely different connection in the relations between Indian and Christian religious literature.

THE SYSTEM OF AVATARS.

As with the two details just discussed, the case is the same with Weber's conjecture "that the entire Indian sect organization, in so far as it is founded on the exclusive worship of a single personal God, owes its origin to Christian influences," and with his assumption "that even the whole avatâr system has originated in an imitation of the Christian dogma of the descent of God."[35] This last assumption has already been contested by Lassen[36] on the obvious ground that Krishna was known as an avatâr of Vishnu even to Megasthenes, hence about 300 B. C. But still other points may be arrayed against it which are at the same time directed against Schroeder's conception.[37] According to his view the Brahman avatâr theory has been influenced by, and has indirectly arisen from, the Buddhist doctrine of the previous existences of Buddha according to which he had often been a god before his last birth (twenty times Indra and four times Brahman) and otherwise had appeared in the most divergent forms of existence. But the Brahman theory of avatârs is older than the stories of Buddha's previous existences which have their origin in

[34] "Contributions of Buddhism to Christianity," *Monist*, XXI, 550 ff.

[35] *Indische Studien*, II, 169.

[36] *Indische Altertumskunde*, 2d ed., II, 1126.

[37] *Indiens Literatur und Kultur*, 330.

the general belief in the transmigration of souls. This we know from the story in the Shatapatha Brâhmana of the supernatural fish that saved Manu from the deluge and in which, according to later interpretation, the god Brahman or Vishnu was incarnated.[38]

Vishnu's incarnation in the form of a fish stands at the head of the ten (later twenty-four or twenty-eight) avatârs, and because of its connection with the fish in the Shatapatha Brâhmana must be looked upon as the oldest idea in this cycle of myths. It certainly is not an accident that Vishnu appears in exactly the first four incarnations in animal form and in the six following in human form. The primitive worship of totem animals which merged into the Vishnu cult underlies the first forms, the fish, the tortoise, the boar and the (man-)lion. But it is not from this source alone that the avatâr theory is derived but from a combination of several. In the Rigveda all light phenomena are frequently conceived as forms of the fire god Agni. In 5, 3, 1, it is even said: "Thou art Varuna, O Agni, when thou art born; thou becomest Mitra when thou art kindled; in thee exist all gods, O Sun of power, thou art Indra to pious men," and in later portions the most different gods are explained to be only names for the *one* god. In the Yajurvedas and in the Brâhmana literature a number of gods are identified with earthly objects and existences: Pûshan with cattle, all gods with water, Agni Vaishvânara with the year, the earth, the sun; Prajâpati with the sun, the earth, the sacrifice; but mainly Vishnu with the sacrifice.[39] This ancient and genuinely Indian tendency towards identification—especially in its later manifestation in Vedic prose where it luxuriates in unrestrained fantastic, yea even idiotic, fashion — is

[38] Pischel, "Ursprung des christlichen Fischsymbols," *Sitzungsberichte der K. Preuss. Akad. der Wiss.*, 1905, 512ff.

[39] Schroeder, *op. cit.*, 134.

surely only a direct preliminary step of the train of thought which has brought forth the doctrine of Vishnu's avatârs and of the incarnation of other gods in remarkable men. There can here be no question of Christian influence.

CONCEPTION OF THE TRINITY.

Nor has the idea of the Trimûrti, the divinity manifesting itself in the three forms Brahman, Vishnu, and Shiva, which lies at the bottom of all Hinduism, anything to do with the Christian trinity; for it is pre-Christian and has reference to the ancient Indian idea of the sanctity of the number 3. Nevertheless the Christian doctrine of the trinity has exerted its influence on the later development of the Bhâgavata religion.[40]

The monotheism of the Bhâgavatas developed in remarkable agreement with the Christian conception into a doctrine of the simultaneous unity and trinity of the divine being, composed of God, his incarnations and his operative power (*shakti*). Since the god of the Bhâgavatas, the Exalted One (Bhagavat), has become one with Krishna and he in turn with Vishnu, his consort Lakshmî has been explained as the operative power of the Exalted One. In this without doubt the Sâmkhya doctrine of the Prakriti, creative nature, which is opposed to the spiritual principle, had some part; but also the Christian doctrine of the Holy Ghost, and this latter, indeed, in the form in which it existed among the Nestorians. Since the Semitic word for spirit (Hebrew, *rû^{a}ch*) is feminine the Syrian Christians regarded the Holy Ghost as a feminine being and identified it directly with the Virgin Mary. When this is taken into consideration the correspondence between the doctrine of the Trinity as held by the Nestorian Christians and by the Bhâgavatas is extraordinarily close. In the latter the

[40] For the following paragraph Grierson's article "Bhakti-Mârga," ERE, II, 542*b*, has been utilized freely; cf. also JRAS, 1907, 323.

Shakti (or its mythological personification Lakshmî) is regarded as one with the Exalted One and yet as different from him: "She has done everything that he has done and if we speak of him we speak also of her." At the same time Shakti appears as the active disseminator of the true faith which she has learned from him—hence as a separate person.

The worship of Shakti as a separate deity plays the most conspicuous part in the Shiva cult but only in the later Shivaitic sects. Hence we may assume that worshipers of Shiva who belong mainly to the lower classes have received it from the Bhâgavatas as they have similarly done in southern India with the doctrine of bhakti. Nevertheless in the Shivaitic (and related) sects the bhakti yields precedence to an ugly asceticism, to a monstrous trade in sorcery, demons and witches; then too the Shiva-bhakti has hitherto been but little studied so that when later on I shall treat the question of Christian influence on the modern development of the bhakti doctrine I may limit myself to the Vishnuitic sects, that is, to Vishnuites and Ramaites.

RAMAISM.

Heretofore I have only once briefly alluded to the Râmaites (*Mon.*, July, p. 339). Like the Krishnaites they originally formed a monotheistic tribal community and later spread all over India. Their god Râma originated in the same manner as the god Krishna, by the elevation of a human hero to divine dignity. Already in the Râmâyana the admired hero of the epic is deified and explained to be an incarnation of Vishnu, but only in such parts as are distinctly later additions and whose interpolation follows the purpose of impressing upon the reader or hearer the divine nature of Râma.

Krishnaism is older than Râmaism and even to-day is

more widely disseminated in India; but Râmaism is more deeply religious and more spiritual and therefore has its adherents mainly among the more cultured classes of Hindus who are filled with a yearning for contemplation and philosophy, whereas Krishnaism dominates more the well-to-do middle classes inclined towards a merry enjoyment of life.[41]

Râmaism is split up into two different sects which are distinguished not only by clothing and stripes on the forehead—all religious confessions among the Hindus are indicated by colored stripes and marks upon the forehead—but which are also violently hostile to each other, whereas their sentiments towards their common opponents are much more friendly. This is an illustration of a law apparently applicable to all mankind. With regard to their theological views the two Ramaitic schools, the southern and the northern, differ from each other in that the former professes the "cat doctrine," the latter the "ape doctrine." According to the cat doctrine, God (Râma) saves man like the cat takes up her young, i. e., without any participation and free will on the part of man; according to the ape doctrine, man in order to be saved must strive after God and cling to him as an ape to its mother. Here we have an Indian counterpart to the controversy between Calvinists and Lutherans.[42]

The two large religious communities of Krishnaites and Râmaites had not always been strictly separated from each other. The Bhâgavatas—or by their later name Pâñcharâtras which first denoted a subdivision of the Bhâgavatas—were originally so exclusively worshipers of Krishna that for the earlier period we may use the expressions "Bhâgavata religion" and "Krishnaism" as synonyms. This is made clear enough in my exposition in two previous

[41] Hopkins, *Religions of India*, 427, 499; Grierson, JRAS, 1907, 501.

[42] Hopkins, *Religions of India*, 500, 501.

articles (*The Monist,* July and October, 1913). But when the Bhâgavata religion was reformed by Râmânuja in the twelfth century it was either already Râmaized or became so through the influence of its reformer; and this took place to a still greater extent through the best known of Râmânuja's successors, Râmânanda, who lived in the fourteenth century. However, the other Bhâgavata schools (that founded by Madhva at least in its north Indian branch) again made Krishna the object of their worship.

THE BHAGAVATAS AND THEIR SCHOOLS.

At any rate the Bhâgavatas were the first real monotheists and the first proclaimers of bhakti in India. Their faith, which I have above ("Christian Elements in the Bhagavadgîtâ," *Monist,* Oct. 1913, pp. 507ff.) represented as the contents of the Bhagavadgîtâ, they have in the main kept pure down to modern times, though it has undergone many sorts of further development, the most noteworthy of which are the doctrine of the 24 incarnations of the Exalted One, the last being still looked for; the classification of souls; and the development of eschatological conceptions in which are mingled Sânkhya-Yoga and pantheistic ideas. But the fundamental doctrines of the personality of God, of the eternal and individual existence of souls and of the supreme value of bhakti, the Bhâgavatas have always firmly maintained. From the twelfth to the fifteenth century four different schools (*sampradâya*) were established whose founders were Râmânuja, Madhva (or Anandatîrtha), Vishnusvâmin and Nimbâditya. The doctrines of these schools and their many subdivisions, which for the most part refer to the disputed question in what form the Exalted One is to be worshiped, cannot be separately discussed here.[43] We shall simply mention that in

[43] The best account of them is given by Grierson in the article already frequently mentioned ("Bhakti-Mârga," ERE, II, 544ff.) to which I owe also

the third school whose principal representatives are the Vallabhâcârîs, a love to God (Krishna) is demanded which does not bear the character of a son's love to his father but that between youth and maiden. By this means the sensual erotic element, which we have already met in earlier times and which matured some ugly outgrowths, has again been advanced in this branch of Krishnaism. It is interesting to see how the Vallabhâcârîs reconcile with their own doctrines the Vedânta tenet of the absolute unity of the Brahman. They too ascribe its established attributes, existence, thought, and bliss (*Sach-chid-ânanda*) to the Exalted One as to the personally conceived Brahman; but the individual soul in its earthly existence they explain as the Exalted One in a condition in which the attribute of bliss is suppressed, and unsouled matter they explain as the Exalted One in a condition in which the attributes of thought and bliss are suppressed. Together with all other Bhâgavatas they reject the doctrine of cosmic illusion (*mâyâ*) and its consequences. At the moment of salvation the soul again obtains the attribute of bliss and becomes essentially equal with the Exalted One for all eternity. All other philosophical differences between the Bhâgavata schools are inconsiderable.

THE QUESTION OF CHRISTIAN INFLUENCE.

Those who wish to approach the question of Christian influence upon Hinduism must know as much about the religious currents which underlie it as I have here set forth. They must further know that Hinduism is in a constant flux and can absorb everything with which it comes in contact, as it has, for instance, absorbed the cults and deities of the Indian aborigines to the widest extent.

We have seen above (in *The Monist* of October, 1913)

much of my exposition in the following pages. Cf. also Grierson's essay "Modern Hinduism and its Debt to the Nestorians," JRAS, 1907, 311ff.

that the doctrine of bhakti and the fatherly love of God is of native Indian origin. Christian influences could find no better prepared ground than the home of this doctrine. Let us see now under what conditions Christianity has made its influence felt.

The Bhâgavata religion, the religion proper of love in India, which before its reformation was the possession of a superior class of people and was proclaimed in the language of the cultured and educated, the Sanskrit, lost ground in the course of time, lacking contact with the broader masses. It almost fell into oblivion since the ninth century when the higher intellectual life of all India came under the spell of Shankara, the great Vedânta teacher who brought the ancient half theistic and half pantheistic Brahmanism of the Upanishads into a unified and consistent philosophical system. The political transformations also and the terrible sufferings which the Mohammedan conquests had spread abroad over India since the beginning of the eleventh century were conducive to the collapse of the bhakti religion. Thus it happened that in the twelfth century this religion numbered only a few adherents living in the southern part of India. Nevertheless it awoke there to new life and with such success that since that time everything which goes by the name of Vishnuism in India is at bottom only a form of the bhakti religion.

It certainly is not an accident that this resuscitation of the bhakti religion took place in the close vicinity of the Nestorian colony of St. Thomé, the alleged monument of the Apostle Thomas at Mylapore not far from Madras. The Christians there had given up baptism at that time (but not the Lord's Supper) and had adopted some religious customs of Hinduism. This goes to show a close friendly community life with the Hindu sects in that locality, and a *mutual* exchange of religious elements. At the present day Christian altars may still be found in southern

India before which both Christians and Hindus worship, each in his own way.[44]

RAMANUJA THE REFORMER.

In the beginning of the twelfth century Râmânuja, the above-mentioned reformer of the Bhâgavata religion, was born at Perumbûr and received his education at Kâñchîpura, now Conjeeveram. Both places are so near Mylapore that Râmânuja must have come in touch with the Nestorian Christians. I therefore agree with Grierson[45] that it must be due to their influence that Râmânuja, originally a follower of Shankara, the most important monist and scorner of bhakti, became converted to the Bhâgavata religion when a young man and devoted himself with great zeal to its propaganda, emphasizing, to be sure, the philosophical rather than the peculiarly religious side.[46] The Christian influence is clearly seen in some of his teachings which I shall discuss farther on. In his famous commentary on the Brahmasûtras, the main text-book of the Vedânta philosophy, Râmânuja sets forth very skilfully the conviction of all Bhâgavatas that the dogmas of their religion are in harmony with the main contents of the Upanishads.

A controversy in which Râmânuja refuted his old Vedântistic teacher engendered great bitterness towards the reformer, and persecutions compelled him to take to flight. But this proved of the greatest advantage to the faith he preached. Râmânuja's flight was the cause that the bhakti religion spread anew over the greater part of India from the most southerly point of the Himalayas.

[44] Grierson, JRAS, 1907, 312.

[45] *Ibid.*, 317.

[46] Madhva also, the founder of the second principal school of the Bhâgavatas, to whose faith he became converted in later years, was originally a Vedantist and like Râmânuja had lived within reach of Christian influence. He was born on the western coast of India about 1200 in Udipi near Kalyâna, the ancient episcopal see. Grierson, ERE, II, 549*b*, note.

The fact that this religion revived in southern India to new vigor and was again brought thence to the north where it continued to receive fresh sustenance from the south, is illustrated in an allegorical tale[47] of the Bhâgavata Mâhâtmya, an appendix of the Bhâgavata Purâna. Nârada relates (I, 27ff.) that in the current eon, Kaliyuga, he had wandered through all India without being able to find Righteousness. Finally he came to the banks of the Yamunâ, to the former scene of Krishna's exploits. There he met two old men lying at the point of death and a young woman mourning for them. To Nârada's question who she was, she replied: "I am Bhakti. These two are considered to be my sons. They are Knowledge (*Jñâna*) and Freedom from Desire (*Vairâgya*), and are become decrepit through the influence of (the present) time. . . . I was born in Dravida [eastern Dekkhan]; I grew up in Karnâtaka [on the south-western coast]; I became old as I dwelt sometimes in Mahârâstra [in the Mahratta country], and sometimes in Gurjara [Gujarat]. There under the influence of the terrible Kali Yuga, my limbs were mutilated by heretics, and with my sons I fell into a long continued feebleness. Since I came to Vrndâvana [on the left bank of the Yamunâ near Mathurâ] I have recovered and am now young and beautiful." She goes on to ask why her two sons have not also become young. Nârada explains that she has been rejuvenated by the holy influence of Vrndâvana, but that Knowledge and Freedom from Desire still remain old, as there is no one who will accept them.

The author of this story means to say that the doctrine of bhakti first originated in southern India and that thence it came north especially to the vicinity of Mathurâ where it attained a remarkable vigor. But he does not seem to have known that the *original* home of the bhakti doctrine

[47] Communicated by Grierson, JRAS, 1911, 800, 801.

was in the exact locality where he makes her regain her youth.

From this legend I now return to Râmânuja. The charming enthusiasm with which he proclaimed the comforting doctrine that a personal God who once appeared on earth in the form of Râma now lived in heaven and bore a part in all man's cares and sorrows, everywhere won the hearts of the oppressed. Râmânuja's disciples also traveled through the country, living only for the extension of their faith in abject poverty and everywhere gaining disciples and followers. It was a time of high strung religious excitement in which ecstacies, visions and alleged miracles were daily occurrences. In many places cloister-like establishments (*matha*) arose in which the mendicant teachers found temporary refuge and where they could end their days after they had become old and feeble.

CHRISTIAN INFLUENCE ON RAMANUJA.

Christian influence seems to me to have been exerted on Râmânuja not only in his theological fundamental conception but also in the following points:

Before his time sin had been regarded as disobedience to divine commands as set forth in the sacred texts, and as something to be avoided because of punishment which was certainly to be expected in a future life. After Râmânuja, the higher conception became dominant, that sin is what is not done in faith; that sin is sin because it does not agree with the nature of the God of love become flesh.[48]

Grierson[49] also considers as an imitation of Christian custom the extraordinary veneration which the Bhâgavata religion accords to the spiritual teacher. This veneration *might* have been strengthened by the Christian example, but at bottom it is genuinely Indian; for from time im-

[48] Grierson, ERE, II, 550, *ab.*

[49] *Ibid.* and JRAS, 1907, 323, 324.

memorial the teacher (*guru*) in India has always enjoyed just such an exaggerated regard.

On the other hand I agree with Grierson when he explains[50] the sacramental meal, which was celebrated in the Râmânuja community as well as in many other bhakti sects[51] under the name Mahâprasâda, "great mercy," and played a very important part, as an imitation of the Christian celebration of the eucharist. To be sure the correctness of this conception has been contested by Berriedale Keith[52] who with reference to Frazer's rich collections and to the investigations of Robertson Smith on the religion of the Semites, draws attention to the fact that such sacramental meals belong to the most widespread religious customs, that they are older than Christianity, and that they have been met with among peoples in a low stage of civilization who had as yet had no contact of any kind with Christianity. Without doubt this is right; but the manner in which the Mahâprasâda feast is celebrated shows a series of parallels with the Christian communion service which cannot rest upon chance. On the evening of the appointed day the community gathers together and the leading priest who is the celebrant (*mahant*) holds a discourse, after which the worshipers are given a short time for prayer and meditation. All withdraw who do not feel worthy to participate in the ceremony proper. The rest approach the celebrant in turn, and each receives in his right hand a small consecrated wafer and two other consecrated morsels. He then turns to another priest who pours a few drops of water upon his hand. This food and this water are thought to secure eternal life to those who partake and are worthy to receive it. Part of the sacra-

[50] *Ibid.*, and JRAS, 1907, 326.

[51] An exact description of the ceremony as it is practised among the Kabirpanthis is given by Foss Westcott in *Kabîr and the Kabîr Panth*, 1908, 127.

[52] JRAS, 1907, 492, 493, 939.

mental food is retained and carefully treasured to use for sick people.

Grierson is also right in referring the instigation of the introduction of the Mahâprasâda ceremony to the Nestorians in southern India instead—as others have done—to the Jesuits at Akbar's court. The following arguments contend against the latter assumption: (1) The wide dissemination of the Mahâprasâda celebration over all India; (2) its frequent mention in the Bhaktamâlâ (to be discussed later); and (3) the fact that among the Kabîrpanthîs the ceremony is followed by a great love feast which is not a Roman Catholic institution but which was customary among the Christian communities of the early days and which was retained by the Christians of southern India who were shut off from the rest of the world.

Moreover Christian influences may be recognized in Râmânuja's doctrine of the equality of all castes. Nevertheless Râmânuja did not put into practice this humane fundamental principle, for in his time all teachers and leaders of the new community were exclusively Brahmans, and people of lower castes were not even admitted as pupils into the clergy. But exactly the circumstance that the principle of universal brotherhood remained a theory with Râmânuja may be looked upon as an indication that it was established at Christian instigation. When Râmânuja accepted from the Christians the doctrines which he heartily shared, he did not wish to reject that of the equality of all mankind although it was not sympathetic to him, a born Brahman. He adopted it but made no use of it.

THE REFORMER RAMANANDA.

His successor Râmânanda at the end of the fourteenth century was the first to take seriously the equality of rights of all castes. Like Râmânuja, Râmânanda was also under direct Christian influence, and like Râmânuja also he en-

tered into controversies with his teacher Râghavânanda, the head of the cloister founded by Râmânuja in Seringapatam. The occasion of the dispute shows how greatly this teacher and the band of scholars surrounding him were entangled in Brahman caste prejudice. Râmânanda had made extensive pilgrimages upon which, according to the opinion of his fellow pupils which Râghavânanda shared, he could not have observed punctiliously all the Brahman food regulations. He was therefore condemned to take his meals alone apart from the other pupils. This ridiculous quarrel was of extraordinary advantage for the religious life of India; for it resulted in an immense extension of the bhakti religion. Râmânanda was highly enraged at the indignity done him and determined to emigrate to northern India where he founded the sect of the Râmânandîs.

The great service of this man for the advancement of the bhakti religion, which in the half-century following his death was the most widely spread in India, consisted of the following innovations. He departed from the prevailing custom of preaching and writing in Sanskrit, and by the use of the vernacular made the doctrines of his religion accessible to all classes of the population. At the same time he put into practice the principle of the brotherhood of man by admitting members of all, even the lowest castes, not only as members of his sect but even as teachers. Evidently borrowing from the details of primitive Christianity, Râmânanda gathered *twelve* disciples about him, among whom were a hair-dresser, a worker in leather,—hence men from greatly despised castes—and the Mohammedan weaver Kabîr who together with Mohammedan doctrines accepted Christian doctrines especially and rejected every sort of idolatry. Kabîr taught that all religious externalities are without avail and that everything depends upon the inner man. Some sayings of Jesus he translated

almost literally and spoke of the "Word" in expressions which can only be a paraphrase of the beginning of John's Gospel: "In the beginning was God alone, but from him went forth the Word. When God desired that creation should come into being, he gave command through his Word and so through the Word were all things made which exist. Although the Word proceeded from God, yet is it not different from God but abideth in him, as thought abideth in the heart of man. God's voice sounds in order that men may have knowledge of the Word; and so the Word is in the world and at the same time with God."[53]

MODERN SECTS.

Like the number twelve of the disciples of Râmânanda, so the number ten of the commandments in the Bhâgavata school founded by Madhva is apparently an imitation of Christianity, even though their contents agree with the Christian ten commandments only in very broad outlines: "Thou shalt not lie, slander no one, use no harsh words, talk not idly, steal not, commit not adultery, kill not, think no evil, hate not, and be not proud."

In the sixteenth and seventeenth centuries the influence of the modern Christian mission upon the spiritual life of India had already become so strong that religious disputations between Hindus, Mohammedans, Christians and Jews were a daily occurrence, as we learn from the Dabistan, a Persian work written in the year 1645.[54] Although obviously modern relations do not properly belong in the scope of my exposition yet I will mention two works of this period filled with Christian influences which have exerted and still exert a very important effect upon the religious life of India. I mention these works especially because the millions of Hindus who read them with enthusiasm do not

[53] Grierson, ERE, II, 550*a*; JRAS, 1907, 325 according to the communications of Foss Westcott.

[54] Hopkins, *Religions of India*, 510 note.

know that it is the Christian spirit which speaks to them from many passages of these books. These are the Hindî version of the Râmâyana by Tulasîdâsa (Tulsîdâs) and the Bhaktamâlâ of Nâbhadâsa (or Nârâyanadâsa) likewise written in the earlier Hindî dialect. Both authors wrote towards the end of the sixteenth century and were teachers of the Râmânandî sect; but their works are esteemed equally highly by the other Bhâgavata schools.

TULASIDASA.

Talusîdâsa (1532-1623) in several works—but especially in his vernacular Râmâyana, which however is not a translation of the ancient Râmâyana of Vâlmîki but an independent exposition of its contents, with the proper title *Râm-charit-mânas,* "The Lake of Rama's deeds," — preaches a strict ethics and especially man's duty towards his fellows, and in so doing has touched the note which speaks to the heart of the masses. If the atrocity and filth of Shivaism and the sexual licentiousness of later Krishnaism have been checked in modern India it is mainly due to the influence of this work and the teachings of Talusîdâsa as a whole. His Râmâyana is found alike in peasants' huts and Râjâs' palaces, and in the market places are to be seen public readers of the poem surrounded by attentive listeners of all classes. The book has been made accessible to the Occidental public in an excellent English translation by F. S. Growse (three volumes, 5th ed., Cawnpore, 1891).

The fundamental features of the religious doctrine of Talusîdâsa in which Christian influence is unmistakable may be summed up as follows:[55] Man is by nature thoroughly corrupt and unworthy to be saved from the consequences of sin, but the supreme being in his infinite mercy has descended to earth and has become man in the person of Râma in order to redeem the world from sin. Having

[55] With Grierson, JRAS, 1903, 456, 457; 1907, 320.

returned to heaven God knows from his own experience how great are the weaknesses and temptations of man, and he practices infinite mercy in constant readiness to help the sinner who invokes him. Even the worst criminal who earnestly repents is thereby purged from sin.[56] From these fundamental conceptions are derived the duties towards one's fellows and the doctrine of the brotherhood of man.

The other divinities of Hinduism are subordinate to God (Râma) and are thought of as standing in a relation to him which is comparable to that of the angels and saints towards God as it is conceived in the Roman Catholic church.[57] Particularly noteworthy in this connection is the position of Hanumat who always appears as Râma's personal servant in heaven. Grierson relates a beautiful legend which, though not told by Tulasîdâsa himself, may be traced to his direct influence.

A miserable crossing-sweeper suffering from a repulsive disease lay in a wretched muddy place and cried in his misery: "Ah Râm, ah Râm! (O God, O God!)." Hanumat was flying by at the time and angry at hearing the name of his Lord cried in such disgusting surroundings struck the man on the breast. That evening when according to his usual custom he was rubbing Râma's body he observed a frightful wound upon the god's breast. Horrified Hanumat asked what had happened. "Thou gavest a poor man a blow on the breast when he invoked my name, and what thou hast done unto the least of my children thou hast done unto me."

THE BHAKTAMALA.

The other work above mentioned, the Bhaktâmâla of Nâbhadâsa with the commentary of Priyâdâsa, Grierson calls the *Acta Sanctorum* of the four great Bhâgavata

[56] *Ibid.*, 1903, 454, 455.

[57] Grierson, JRAS, 1903, 457-458.

schools.[58] Not only the main doctrines of this work but many details in it betray Christian influence as distinctly as can be. Thus we have the legends of Gopâla who when he received a blow upon one cheek offered the striker the other also (Bh. 106 = Matt. v. 39); of Vilvamangala whose eye offended him because he had looked at a woman with desire and who therefore blinded himself (Bh. 46 = Matt. v. 29); and of the anonymous king of Purî who for the same reason chopped off his right hand and cast it from him (Bh. 51 = Matt. v. 30).[59] In Bh. 204 are given examples of the kindness which the incarnate God has manifested toward his servants. One of these is that Krishna washed the feet of his servants. Even in Mahâbhârata II, 1295, it is related how Krishna demeaned himself to wash the feet of Brahmans; but in the Bhaktamâlâ we have instead of Brahmans "*santas,* i. e., the bhakti-filled." The original Indian legend therefore seems by this alteration to have been brought into harmony with the New Testament narrative (John xiii. 5).[60]

AVENUES OF CHRISTIAN INFLUENCE.

That the Christian influences upon the various Bhâgavata schools which we have here discussed originated, as far as the time before the sixteenth century is concerned, with the Thomas Christians of southern India may be regarded as certain. After the sixteenth century the bhakti

[58] "It is a storehouse of legends regarding the saints, ancient and modern, of the Bhâgavata religion. The importance of this book for a just comprehension of the religious attitude of modern Hinduism cannot be overrated, and it is a matter for regret that the great difficulties of the text have deterred European students from its study. In its original form few natives can understand it nowadays, but numerous translations into modern Indian languages have made its contents familiar to every follower of the cult. For northern India, it and Tulasî-dasa's Râmâyana are the two text-books of modern Bhâgavatism." ERE, II, 546*a*. The contents of the work are given in detail by Grierson in his essays, "Gleanings from the Bhaktamâlâ," JRAS, 1909, 607ff.; 1910, 87ff., 269ff.

[59] Grierson, JRAS, 1907, 322, 496; ERE, II, 548*b*.

[60] Kâshîprasâ Jayaswâl in Grierson, JRAS, 1907, 322, Note 5.

sects of northern India may have gained new support from Christian missions. But almost all the notable bhakti teachers from Râmânuja to Nâbhadâsa—that is, from the twelfth to the end of the sixteenth century—were from southern India and must therefore have received their Christian impulse from the Thomas Christians in southern India who possessed a Christianity that was distorted in many respects.

This disposes of the assumption of J. Kennedy and others that Christian influences effected the revival and reform of the bhakti religion through the mediation of Persian sûfism. Sûfistic influence can be considered only for the bhakti sects of northern India that developed in Mohammedan surroundings, and for a later time. With this limitation, however, it must be recognized.[61] The previously Mohammedan Kabir (beginning of the fifteenth century) mingled Christian and sûfistic doctrines; and the modern bhakti sect (founded towards the end of the sixteenth century) of the Râdhâsvâmins (or Râdhâvallabhîs) is based upon Kabîr, the sûfîs, and the Gospel of John.[62]

Although several bhakti teachers have departed from those principles of Brahmanism which it has considered from time immemorial as basic pillars of the religious system, yet they have not severed connection with Brahmanism. Even the reformers of the present time, in spite of the closer relations to Christianity in which they find themselves, have held fast to certain elements of Brahmanism or have started from them.

BRAHMA SAMAJ.

Râm Mohan Roy (1772-1833), the founder of the Brâhma Samâj, and his successors in the leadership of this philanthropical sect, are especially to be mentioned in this

[61] Grierson, *ibid.*, 501-503; ERE, II, 550*b*.

[62] J. Kennedy, JRAS, 1907, 487, unfortunately (as so often) without authorities.

connection. It is well known that the Brâhma Samâj endeavors to obtain man's higher happiness through a conciliation of the great religions by rejecting all special forms of worship. Râm Mohan Roy started with the pantheism of the Upanishads but later attained to faith in a personal God, and although he never relinquished his membership in the Brahman caste confessed in the course of his spiritual development more and more a leaning to the teachings of Christianity, which he declared to be the best of all religious doctrines. He came finally to believe in the last judgment, in the founding of the true religion by Christ and in the miracles ascribed to him. But the dogma of the trinity he resolutely rejected.[63]

Of Râm Mohan Roy's successors we need only mention Keshab Chunder Sen who departed from all the prejudices of Hinduism and laid aside the sacred cord, the mark of his caste. As he did not succeed in introducing his far-reaching reforms into the Brâhma Samâj he founded in 1866 a new church under the name "Brâhma Samâj of India" which received its religious stamp from the ecstatic form of the bhakti. With his own peculiar ardor Keshab Chunder Sen in the year 1880 proclaimed his faith in the truth of Christianity in the following words: "It is Christ who rules British India, and not the British government. England has sent out a tremendous moral force in the life and character of that mighty prophet to conquer and hold this vast empire. None but Jesus, none but Jesus, none but Jesus, ever deserved this bright, this precious diadem, India, and Jesus shall have it. . . . Christ is a true Yogî."[64] But to Keshab Chunder Sen, in spite of this paeon, Christ was merely an ascetic corresponding to the Brahman ideal, and at a later time K. Ch. Sen set up a combination of

[63] Monier-Williams, *Brahmanism and Hinduism*, 488; Hopkins, *Religions of India*, 516.

[64] Monier-Williams, *op. cit.*, 516; Hopkins, *op. cit.*, 521.

Hinduism, Islam and Christianity as the true religion. Nevertheless in these progressive reformers Christianity formed a strong support for their religious conviction. It has on the whole exerted the most beneficial influence on the Brâhma Samâj in its various stages of development, not only in dogmatic but also in moral and social respects. In its Sunday services sections from the Bible are now read side by side with those from the Veda, the Avesta and the Koran.

J. M. Farquhar[65] gives the number of Brâhma Samâj congregations at the time of K. Ch. Sen's death in 1884, as 173 with about 1500 covenanted members and about 8000 adherents; the census of 1901 gives 4050 members (as against 3051 in the year 1891). These statistics show that there have always been only small congregations and that the whole movement, as was to be expected, has remained limited to the most intelligent classes.

Apart from this consciously eclectic movement it is not easy properly to estimate the strength and extent of Christian ideas which have entered into the Hinduism of to-day through various avenues. Grierson, the most competent judge of these imponderabilia and the best expert in the modern (vernacular) religious literature of northern India which is but little known in Europe, has given the following noteworthy statement: "I approached the terrain with a mind absolutely free from preconceived ideas, and with altogether different objects. At first I was struck with what I thought were coincidences, but as I went on and grew more and more familiar with the country, the Christian element in the atmosphere was more and more impressed upon me. There was plenty of nitrogen and carbonic acid, not to speak of argon, but the oxygen was identical with the teaching of our Gospels. This is a case of impression, which it is impossible to justify by formal

[65] In the extensive article "Brâhma Samâj," ERE, II, 821*a*.

proof; but there it is, and I offer it for what it is worth."[66] With these words we must combine what Grierson has said in another passage[67] with special emphasis: "At the present time *it cannot be too emphatically stated that modern Hinduism is at its base a religion of monotheism.* (Footnote to this passage:) The gross cloud of combined polytheism and fetishism which covers and hides this monotheism, is kept, even by the unlearned Hindus, upon a different plane of thought. The monotheism has to do with the future life and with what we should call 'salvation.' The polytheism and fetishism serve only for the daily needs of the material world. In a country where, as in India, the majority of the people are poor and ignorant, the material overshadows the spiritual; but even the poorest recognizes (even if he think them too high for him) the truth of the doctrines concerning the One Supreme Being, which have descended to him from the Bhâgavatas."

It is not easy for me to contradict a scholar of Grierson's eminence who has lived for a generation among and with the Hindus and for this long period has devoted much of his best strength to the investigation of their religious conditions. But here we have a judgment of a wholly subjective character. I therefore believe that although my stay in India extended only over a year and a half, I am not required to withhold my conviction that Grierson in his sympathetic enthusiasm overestimates the scope of monotheistic tendencies and the Christian elements in the Hinduism of to-day. I have throughout received the impression that polytheism and fetishism form essential characteristic features of Hinduism and do not merely lie above it like a fog concealing its true nature!

In the introduction to the exceedingly valuable article "Bhakti-Mârga"[68] which I have frequently cited, Grierson

[66] JRAS, 1907, 500, 501. [67] JA, 1908 262.
[68] ERE, II, 539a.

says that the doctrine of the bhakti forms the foundation of the modern Vishnuitic Hinduism, and that at least 150 millions of the inhabitants of India profess it. Now according to the census of 1901 the number of Hindus amounts to 207 millions, and this includes—besides eight and a half million animists—the rural population which still constitute the majority in India and whose religion consists in fact in the worship of a vast host of racial and local deities. Further deducting the great mass of Shivaites we find that Grierson has estimated the number of Vishnuites (Râmaites and Krishnaites) much too high.

Among the number of Christian elements demonstrable in Indian literature which I have collected in the last part of this essay probably nothing of importance is omitted. We must grant that these Christian additions are pretty considerable in number from the seventh century on and represent a valuable enrichment of Indian religious wealth; but it must not be maintained that they occupy any overwhelming place in their surroundings. *In the whole religious atmosphere* of the Hinduism of to-day Christian elements naturally play a less important part than in the literature belonging to the educated classes.

RICHARD GARBE.

UNIVERSITY OF TÜBINGEN.

CEREMONIAL SPITTING.

THAT a volume might be filled with citations of cases of ceremonial spitting is familiar to every ethnologist. So large a body of material need not be presented in any study of the significance of the rite. Its origins are probably includible in a short paper. Three suggestions are presented here for consideration.

I.

Bulwer-Lytton, in the amphitheater scene in the *Last Days of Pompeii,* makes the furious and frenzied Calenus carry the day against Arbaces by going into convulsions and shouting "A god! a god! I feel the god rush to my lips!" This view of epileptic and convulsive seizures is world-wide, and is familiar enough in general literature, classical and modern. But since foaming at the mouth as well as tremors, prove to the primitive mind the presence of some superhuman agency, the conclusion is easily reached that inspiration or obsession is readily communicable by means of the saliva of the convulsed or inspired person. This hardly means that the effect has been everywhere taken for the cause; rather would it appear to be an illustration of the failure of primitive minds clearly to dissociate matter and spirit in their thinking—a leading factor in all animistic beliefs. Two sharply defined, independent realms are, I think, not at all conceived at first, and because of this fact, mysterious powers of inspired or holy men are widely

considered communicable by some form of physical contact, just as heat and cold, or color of inks, or dyes, may be communicable.

So in the Semitic world, the *baraka* or "blessing," the mysterious powers of a holy or inspired man, are communicated by the saliva. At initiation into a dervish order the sheikh or head of the order spits on the hands and forehead of the candidate; among the Rufaiyeh the custom is to spit in the candidate's mouth.[1] The like custom is general throughout North African states; every candidate for "holy orders" and every suppliant of a holy man, is likely to have his mouth spit in, as a token of divine favor.[2] So in Central Africa the head priest of the Warua spits in the face of any inquirer whom the god delighteth especially to honor.[3] I doubt if in this case, however, any special powers are acquired by the recipient. In the cuneiform literature the same conception is prominent. The word of a god comes upon a man, and is indicated by shivers or tremors of the *bārū*, "seer," or *sha'ilu*, "necromancer" or medium.

We read of Bêl Marduk,[4]

"His word is brought upon the *bārū*, and that *bārū* shivers.

His word is brought upon the *sha'ilu*, and that *sha'ilu* shivers.

His word is brought upon the *idlu* (youth?) in woe(?) and that freeman moans.

His word is brought upon the maiden, and that maiden moans."

Jastrow[5] cites fifteen lines about Nergal, in which the above also occurs. He thinks some plague is meant. I

[1] Bliss, *Religions of Modern Syria and Palestine*, 218.
[2] Montet, "Le culte des saints dans l'Islam," *Hibbert Journal*, July, 1909.
[3] Cameron, *Across Africa*, 315.
[4] Banks, *Sumerisch-babylonische Hymnen*, 9.
[5] *Die Religionen Babyloniens und Assyriens*, 475-6.

doubt if that is the only effect of the "word of Nergal" that is intended. The passage I quote describes fairly what any one may see in a seance to-day in America, when a medium is going "under control," and is interesting as indicating transition from the cult and inquiry of the dead to a conceived greater power, a king of the dead, as both Bêl and Nergal are sometimes conceived. Compare Ezekiel's dumb seizures and David's slobbering madness. The process of communication is the same. Take this specimen:[6]

"The *ashipu shangumahhu* of Ea am I,
The messenger of Marduk am I;
To revive the sick man
The great Lord Ea hath sent me.
He hath added his pure spell to mine,
He hath added his pure voice to mine,
He hath added his pure spittle to mine,
He hath added his pure prayer to mine."

It is a fair conclusion that this ancient Semitic physician, priest or exorcist received inspiration by having his mouth spit in, at ordination, like his modern confrères. The purifying power of spittle, especially of the gods, is familiar in ancient Egyptian texts, the spittle of Horus and Set[7] suggesting that of Marduk and Nergal. In Mark vii. 33, Jesus spits and touches the tongue of a stutterer—I suspect with saliva—to give fluency of speech.

This power of spittle to impart the gift of speech is very prominent in folk-tales. Miss Cox cites fourteen tales from Russia, Scotland, Hungary, South Africa, Poland, India, Germany and Scandinavia, in which spittle will speak when spat upon the ground and questioned; or, since in most cases some object spat upon thus acquires the gift of speech, perhaps we should conclude that the

[6] Thompson, *Devils and Evil Spirits of Babylonia*, 13.

[7] Budge, *Osiris and the Egyptian Resurrection.*

earth acquired this power when spat upon, in older forms of the tales. "In the Edda, the spittle of waves was shaped by the gods into a man, whose blood, when he was slain, was mixed with honey and made into mead of which if a man drink he becomes a poet and a sage."[8] In this case three familiar sources of inspiration, spittle—perhaps of a sea god—blood-drinking and mead-drinking, have been fused into one myth. In the *Folk Tales of the Magyars* (p. xxxiii) the fairy Helena confers the gift of speech upon the floor, the door handle and the hinge, by spitting upon them.

Among the Zulus, the diviner infuses power or vitality into his divining sticks or chips—substitutes for ancestral bones—by spitting upon them. They then leap about, and by their motions reveal to him anything he wants to know.[9] The like custom in using the divining bones is widespread in Africa; and the superstitious negro "crap shooter" in our own land still attaches importance to his spitting in "throwing the bones."

In Africa we find this same deputation of authority by spitting. Old Katchiba, appointing his brother as guardian and deputy weather clerk for Sir Samuel White Baker on leaving Obbo, breaks a branch from a tree, spits upon it several times, and lays it on the ground. A fowl is dragged around it, and rubbed over the feet of Baker's horse before being sacrificed. The "blessed branch" is then given to Katchiba's brother. With this magic wand, and a rain-whistle of antelope's horn hung upon his neck, he enters upon his duties. Later, Katchiba learned that Baker and his wife were sick. Liberally "blessing" a branch and waving it about their heads, he then stuck it in the thatch over the door of the hut as a guardian power; evidently the evil could not return while this strong armed

[8] *Cinderella*, p. 518, note 69.

[9] Callaway, *Religious System of the Amazulu*, 330.

spirit kept the house. As the sick people undoubtedly recovered, who can deny the potency of a branch so blessed?[10]

Fetish-making, as every ethnologist knows, is inducing a spirit to take up its residence in some convenient object which the maker or buyer then carries about with him for his own protection against other powerful spirits. It is natural then for the African in many cases to conclude his process of manufacture by spitting upon the magical device, and the value of the rite depends upon the rank of the spitter. Thus in making the great traveling or war fetish in Garenganze, the final step is the spitting upon it by the king.[11] To be classed with this process probably, is the custom among the neighboring Barotse, of protecting an article from thieves by spitting on straws, and sticking them around it.[12] But this may mean that the straws thus acquire the gift of speech and will betray any thief.

Comparable with Katchiba's "blessing" a bough with "holy water," cited above, is the experience of Captain Stigand at a Rendile festival. Every one is expected to have the branch of a certain bush fixed upon his hut upon such occasions, so two elderly masters of ceremonies brought the English captain a bough and spat upon it; and added thereto a spitting upon his hands by way of benediction.[13]

II.

The spitting of reverence is one of the most wide-spread of customs. Daniel Crawford, in *Thinking Black*, several times speaks of the African as trained in "the university of the beasts." Carl Lumholtz in his *Unknown Mexico* describes dances to produce rain which the Indian claims

[10] Baker, *Albert Nyanza*, 207, 211, 250.

[11] Arnot, *Garenganze*, p. 207.

[12] Declé, *Three Years in Savage Africa*, 72.

[13] *To Abyssinia Through an Unknown Land*, 101-2.

were taught him by the deer, the turkey, etc. In *New Trails in Mexico,* the "Frog Doctor" teaches rain making; that is to say, the curious behavior of some animals before a rain is construed as a cause, not as an effect. It is a rigid application of *post hoc, ergo propter hoc,* and so in various parts of the world animals behaving oddly before a rain acquire a reputation for rain making. In like manner, the animal mode of expressing affection does not pass unnoticed. "If I were a cow with a long tongue, I would lick you all over," said an African chief to John Campbell[14] by way of welcome. So we have courteous greeting by way of licking or spitting all through Africa, and a logical expansion into ceremonial worship. Dr. Nassau tells us that in West Africa one blows, puffs, or spits a blessing upon the head or hand of a child, so that the word *tuwaka* may be understood to be "bless" as well as "spit."[15] In modern West African custom it is commonly a sharp puffing with no emission of saliva, suggesting transition into "breathing a blessing"; but the name for it, "spitting," remains. Among various tribes in South Africa when a child is born various sacred herbs are hung up at the door of the hut, and every visitor to the babe must chew some of these, and spit or puff at the child. A mother absent from her child a short time chews some herbs hung around the child's neck and puffs at it.[16]

Dr. Schweinfurth[17] saw the spitting rite as expressive of fidelity, reverence or attachment, only two or three times while in Africa and thought the custom dying out; but in other parts of the continent it is still in full vigor. In Dinka Land an English official may be met by native chiefs who crawl to him on all fours and spit in the palm of his hand by way of showing good faith. Another form

[14] *Travels in South Africa,* II, 185.
[15] *Fetishism in West Africa,* 99, 213,
[16] *Savage Childhood,* 16, 44.
[17] *The Heart of Africa,* I, 205.

is to lick the palm of his hand.[18] Compare the fact that the son of an African chief may speak of himself as "father's little dog" and the inference is fair that the behavior of a suppliant dog suggested this rite of submission, or the like one of licking or kissing the feet, common in some parts of South Africa and a commonplace in Assyrian royal inscriptions. Among the Nuehr, the salutation is to spit in the face for especial honor. In case of ordinary salutations between friends the hand is held up with spread fingers at the height of one's head, and the friend spits in it.[19] Mr. Petherick in the same region tells of his first experience with the custom. A Nuehr chieftain entered the cabin of his steamer, knelt, and grasped the trader's right hand, spat in it, then full in the white man's face. Astounded, but seeing only benignity in the black face before him, the trader restrained the impulse to knock him down and returned the compliment with great fervor, much to the delight of the old chief, who was thereby assured that Petherick himself was a man of the highest rank.

It is easy to see that if the custom itself is construed as a token of kindliness, affection, or favor, it will be esteemed in proportion to the rank of the spitter. There is no difficulty in understanding the esteem of such favors where no peculiar powers are believed transmitted thereby. Thus in Unyoro at a marriage, the priest of the Bachwezi, or ancestral spirits, spits upon the heads of the pair kneeling before him by way of blessing them. The subsequent rite of killing a sheep, blessing it, presenting some of the meat to the ancestor and some to the kneeling pair, following with a like communion with a cup of banana wine, strongly suggests Christian influence,[20] which the presence of Gallas as Unyoro herdsmen would explain, since Chris-

[18] Mrs. Stevens, *My Soudan Year*, 134-136.

[19] *Ibid.*, p. 218.

[20] A. B. Lloyd, *Uganda to Khartoum*, 52.

tianity once had a foothold among the mountain Gallas of Abyssinia,[21] who still retain a baptismal rite and eucharist, though heathen in all other respects. An infant in Unyoro is blessed at birth by being brought to the priest for him to spit upon.

Similarly, among the Nubas, the priest blesses a child by spitting upon its chest, and there is a christening ceremony in which the child and the relatives are sprinkled by means of a slain chicken dipped in water, and then spitting upon the child.[22]

The very word "spitting" may be used as a synonym for "blessing," or gift. Among the Thonga a groom will probably pay for his wife in cattle, but he may add to the stipulated cattle a present of one sovereign to the bride's father, saying "This is my spitting for you, my father."[23]

Throughout Marotseland, spitting is universal at greeting or parting, and enters into pledges of fidelity and business contracts to some extent, as may readily be inferred. But only children of royalty or near relatives may enjoy the great blessing of being spat on by the king. Declé remarks that actual emission of saliva is unusual; Marotse spitting is merely ceremonial. The distinctions of rank are sharply drawn in spitting; Brazilian Indian chiefs are known to spit in hands of attendants or associates.[24] So the king of Uganda expresses pleasure with those who salute him by blowing and spitting in their hands, which the ardent loyalist promptly rubs on his face and eyes.[25] Spitting is also the chief feature in a Makoba chief's blessing.[26]

[21] Krapf, *Travels in East Africa*, 378, 385.

[22] Mrs. Stevens, *My Soudan Year*, 274, 277.

[23] Junod, *Life of a South African Tribe*, I, 119.

[24] Declé, *op. cit.*, 77; Coillard, *On the Threshold of Central Africa*, 311-12, 369, 394, 469, 524.

[25] Stanley, *Through the Dark Continent*, I, 252.

[26] Chapman, *Travels*, I, 160, 194.

It is clear that amongst a people more democratic or less centralized in organization such salutations are mutual; the rite does not become a mark of rank. So among the Masai and neighboring Wachaga, spitting or spirting water upon each other at meeting, parting, receiving presents, making brotherhoods, or pledges of eternal friendship, in closing contracts, is everywhere in evidence. At closing a trade each man spits upon the article he barters away.[27] The Wachaga kill a sheep or goat in their brotherhood ceremony, each party solemnly spitting on its head; or they spit milk or beer in each other's mouths. The primitive affectionate "cowslick" and "puppy love" could hardly be carried further than it is by these nomadic pastoral peoples. The Akikuyu also spit in all ceremonies of respect and reverence.[28]

Probably derived from this licking or spitting as a mark of respect or esteem is the custom of spitting on the food or drink one offers to an honored guest, especially prominent in some parts of the Malay Archipelago; or the guest's spittle will be a mark of his own esteem. St. John[29] tells of his hospitable reception in a Dyak village. His visit being of good omen for the simple villagers, they bring balls of rice for him to spit on, which they eagerly swallow. Not so easily endured by the civilized visitor is the reverse custom, as on the occasion when the American General Bates and his staff paid a diplomatic visit to the dowager Sultana of Sulu. When refreshments were brought in, one of the chieftains gravely spat a mouthful of betelnut juice in the bowl of liquor provided, which mark of royal favor the visitors were expected to appreciate very highly.

Another interesting advance upon the spitting at greet-

[27] Hinde, *Last of the Masai*, 42-43; Thomson, *Through Masai Land*, 166, 368-69, 379-81, 443; Johnston, *Kilimanjaro Expedition*, 438; Dawson, *James Hannington*, p. 366; Krapf, *Travels in East Africa*, 211, 279.

[28] Stigand, *Land of Zinj*, 237.

[29] St. John, *Life in the Forests of the Far East*, I, 148, 150.

ing or parting may be cited from the Boloki. When a son or daughter is about to travel for any reason, the father chews a certain shrub and spits on a leaf, mixing with it a little camwood powder. The wayfarer takes this mess with him and rubs a little of it on his body daily, to find favor and success wherever he travels. No son or daughter will venture to travel without this paternal blessing.[30]

Perhaps we should group with this reverential spitting the curious Tibetan salutation of thrusting out the tongue; the farther, the more polite or submissive the intention. If beaten in battle, the Tibetan will signify surrender by squatting down and hanging out his tongue; suggesting the behavior of a tired dog. I have seen no ventured explanation of the origin of this custom. But the dog is an ancient sacred animal with the Tibetans. They rejoice at the prospect of being eaten by one when they die and its own stuffed skin is hung up at a doorway or from the ceiling of a room, that its guardian spirit may continue to protect the family. It may be, then, that the hanging out the tongue was originally an imitation of the behavior of a tired or amicably disposed sacred dog. The point is not pressed.

III.

The spitting of worship will be recognized as an inevitable consequence of this spitting of salutation. The gods or ancestors will secure the same marks of respect that are shown to men. The very word "spitting" may be used to express "worship," as among the Balubale, where *kupara,* "worship," is literally "spitting" or "spouting," and the name emphasizes the spirting of herb juice, holy water, or consecrated beer upon the ground, upon all present, and upon the ancestral bones to revive and invigorate the patron ancestral spirits. All present drink after this

[30] Weeks, *Among Congo Cannibals,* 307.

solemn libation.[31] In West Africa a thin veneer of Mohammedanism has been spread over African paganism. The black Moslem may be seen greeting the autumnal new moon by spitting in his hand and waving it three times around his head,[32] a custom really identical with kissing the hand to the new moon, condemned in Job xxxi. 26-28, or the Fijian custom of tapping the mouth with the hand when first seeing the new moon.

This form of salutation of the moon is still known in witch lore in Italy. Leland cites a spell in his *Aradia* (p. 44):

> ".....But I drinking
> In this horn, and drinking the blood,
> The blood of Diana with her aid,
> My hand to the new moon I kiss
> That she may guard my grapes
> At the moment the bud is formed,
> At the time of the grapes growing,
> And at last at the gathering, etc., etc."

In South Africa the same form of worship may be found. The Ama-Zulu, or "Celestial People" celebrate annually in the month of January the festival of first fruits. As the chief comes forth from his dwelling at the moment of sunrise, he spits at the sun three or four times.[33] This was thought by the French missionary Arbousset to be intended as an insult, African customs being new to him. Livingstone[34] is to be credited with a like error. He tells us that the Bakwains on seeing a crocodile at once spit on the ground, saying "There is sin."

The error here is doubtless one of translation. Livingstone labored among the Bakwains, or Ba-quaina, "people of the crocodile" whose totem, or *siboko,* is the crocodile, and knew their superstitious regard for it. The

[31] Crawford, *Thinking Black,* 260.

[32] Reade, *Savage Africa,* 355.

[33] Arbousset, *Exploratory Tour,* 232.

[34] *Travels and Researches in South Africa,* 277.

word he translated "sin" was probably more nearly expressible by "tabu." The spitting was undoubtedly reverential, as it is with South African totem clans generally. We may compare the superstition still found in Yorkshire that when you meet a white horse you must spit, or ill luck will befall you.[35]

The horse cult of the ancient Teutons, "lords of the white horse" as Tennyson calls them, is familiar to scholars, and this Yorkshire practice may be a survival of an ancient form of obeisance or salutation.

Returning to Africa, the Baperi, who reverence and swear by the porcupine, are grieved if any one kills or maltreats the animal. They then collect its quills, spit upon them, rub their eye-brows with them, and lament: "They have slain our brother, our master, one of ours, him whom we sing."[36]

So among the Damara, or Ova-Herrero, whose primitive fire-cult is less obscured by change than that of most African tribes, a hunter never returns from a successful hunt without filling his mouth with water and spirting it at the ancestral fire, as well as three times over his own feet.[37] It is probably a simple obeisance or libation. Among the Lighoyas and other Basuto tribes, there is much fear of the lightning, and a marked effort to control clouds and storms through the *morimo,* or ancestral spirits. At a sharp unexpected clap of thunder, one of a frightened group may ask his fellows: "Is there any one here who devours the wealth of others?" All then spit upon the ground, saying "We do not devour the wealth of others."[38] The formal spitting strengthens the solemn asseveration; as in covenant making, it seems equivalent to an oath. The American negro voodooist still superstitiously regards the

[35] Henderson, *Folk Lore of the Northern Counties,* 116.
[36] Arbousset, *op. cit.,* 257.
[37] Anderson, *Lake Ngami,* 221.
[38] Arbousset, *op. cit.,* 323.

behavior of the fire on his hearth; and if it snaps, sparkles, or gives out other evil omens he promptly spits in it,[39] which may be compared with the Damara fire-cult above cited.

This cultus-spitting must include the world-wide custom of spitting on a stick or stone which one deposits upon an ancestral cairn. It is a familiar fact that these are often only cenotaphs, or wayside erections for any wandering spirits—the original form of the crosses and chapels at European roadsides. All over South Africa they may be seen—piles of brush, poles, or stones, within a few feet of the wayside. Every passer adds a stone or green branch, which he devoutly spits on, and prays for prosperity in his journey. Neglect of these *issivivani* is sure to entail misfortune,[40] and the average Kaffir will spit on a stone and throw one into every stream he crosses as an offering to the water spirits. He will spirt a mouthful of water in the direction of his greatest enemy, or of any kraal where he suspects magic is being used against him. He chews medicines on various occasions, and spits in the same way, to avert mischief. A wounded warrior may go through a purification ceremony, part of which is spitting upon sticks, pointing at the enemy, and then throwing the sticks in that direction. Comparing this with the spitting upon a stick and placing it with a prayer upon the *issivivane* heap, it would appear to be an offering to the protective ancestor spirit of every Kaffir, accompanied with a prayer for vengeance upon his enemy. Mr. Kidd's theory that an explosion of contempt is at the bottom of all spitting rites does not fairly explain the data already cited.

The dead often appear to the Zulu in dreams, and such dreams are thought likely to make him ill. In that case the

[39] Leland, *Etruscan Roman Remains*, 318 note.

[40] Kay, *Travels and Researches in Caffraria*, 186-7; Callaway, *op. cit.*, 435; Kidd, *Savage Childhood*, 16; *The Essential Kaffir*, 9, 10, 308-10.

patient must take herbs prescribed by the doctor, and if the dream comes again he must chew them, spit the juice on a piece of firewood, or a stone, and throw them over his shoulder not looking back. This seems again the *issivivani* custom, an offering to the shade, respectfully avoiding the sight of it. Or the person tormented with such dreams may chew the prescribed herbs and deposit the spittle and stone in a hole he has dug in some remote place. The dream supposedly will not return.[41]

When such minor offerings are not accepted, the patient may be compelled to kill an ox for the ancestral shades. It is to be understood that the stone is a "dummy" offering, in lieu of a real or more substantial one, just as the Moslem may use dust or sand in place of water in his ablutions—a substitution known also in early Christian baptismal rites, when water was scarce. In precisely similar cairn ceremonies the Tibetan to-day will offer a stone when he has no sheep's head, and a handful of dust in place of a libation of wine.[42] That the ghost demanding bread was usually satisfied with a stone was doubtless in mind in Matt. vii. 9, perhaps also in iv. 3. When the New Caledonians lack fish for offerings they will use sacred stones instead, laying them before the ancestral skulls, chewing leaves, and spitting on the stones, saying "Help us to be lucky at our fishing."[43] The spitting upon such dummy offerings, however, might possibly be classified under the first division of this paper, as infusing a spirit or *anima* into any object by spitting on it. The Kaffirs when sacrificing an ox to ancestral spirits shut the meat up in a hut all night, that the shades may "lick" the meat, absorbing its "spirit" so; the earthly family then eat the meat the next day. A similar view of

[41] Callaway, *op. cit.*, 66, 160, 316-317, 435.

[42] Sarat Chandra Das, *Journey to Lhasa*, 190.

[43] Frazer, *Magic Art*, I, 163.

the gods or ancestral shades as "spirit eaters" is familiar in Polynesia.[44]

IV.

More familiar to the general reader is the belief in the healing power of spittle. Primitive man could not fail to observe that an injured wild beast was apt to lick its wounds, and the notion of healing was promptly associated with this habit. So in the famous parable of Dives and Lazarus the oriental beggar, lacking better treatment, allowed the dogs to lick his sores, partly perhaps because of the semi-sacred character attaching to the dog in the ancient world. That wounds in the mouth heal much more quickly than elsewhere, has not escaped the attention of the Oriental enthusiast, and the fact is directly attributed to the saliva. Mr. Oliphant, watching dervishes run skewers through the cheeks without effusion of blood and with only a slight scar, sought for an explanation, and was told that it was due to the healing power of saliva and to the chewing of certain herbs, probably styptic. After making due allowance for all impostures the fact remains that mouth-injuries are in special favor with such enthusiasts.[45] In medical journals I have seen the suggestion that the presence of some beneficial microbes may explain the rapid healing of injuries to the mouth.

But animals do not merely lick; some have the trick of spitting at a wound. Crawford observes that the baboon, familiar all over Africa, will spit on the wound of a companion and rub it with a bit of bark. Livingstone observed similar behavior on the part of the soko in the grassy plains of the Manyuema country, staunching the flow of blood with leaves.[46] The baboon's renown as a rain maker or

[44] Ellis, *Polynesian Researches*, I, 302-3.

[45] *The Land of Gilead*, 350-355.

[46] *Thinking Black*, 143; *Last Journals*, 325.

finder of water in time of drought has been already mentioned; adding this curious behavior, the animal's repute all over Africa as a physician or wizard of vast powers is easily understood. The possession of a baboon skin is in consequence a *sine qua non* with some would-be healers. That spitting should become a chief feature of the savage's healing of a wound, as with the Bushman,[47] is not surprising; and it is just as natural that especial value should attach to the spitting of men of supposed exceptional powers. So Mohammed in his healing, according to Ayesha, habitually used clay made with spittle,[48] and in Palestine the healing of wounds, burns, diseased feet, and serpent bites by the spittle of dervishes, maniacs, epileptics, and other holy men is a matter of every day occurrence.[49] Vespasian at Alexandria was besought to touch the blind with his spittle, and the lame with his foot, and by the aid of Jupiter Serapis, both were cured; so Tacitus and Suetonius tell us. The spitting upon the eyes of a blind man and anointing with clay, is familiar to every reader of the New Testament (Mark viii. 23, John ix. 6). Of the Arabian desert, Doughty reports, "A young mother, yet a slender girl, brought her wretched babe and bade me spit on the child's sore eyes; this ancient Semitic opinion and custom I have afterwards found wherever I came in Arabia. Her gossips followed, to make this request with her, and when I blamed their superstition, they answered simply that such was the custom here from time out of mind. Meteyr nomads have brought me, some of them bread and some of them salt, that I should spit in it for their sick friends. Also the Arabians will spit upon a lock which cannot easily be opened. "They also spit on, or at, malicious *jan,* or spirits; and a father will often say to his infant in arms,

[47] Chapman, *op. cit.,* 160.

[48] Hughes, *Dictionary of Islam,* 658.

[49] Bliss, *op. cit.,* 265-271; Grant, *The Peasantry of Palestine,* 94.

"Spit upon *bàbu*—spit, my darling!"—involving the notion of blessing or favor so familiar in Africa.[50] William Hayes Ward was appealed to for aid for a sick child, on the lower Euphrates. In the opinion of the Sheikh who so appealed, his task was not complete till he spit upon the child.[51] The North African nomad holds like views; spit in a child's face, and the parents esteem it a great favor;[52] and similar opinions survive in the folklore of Europe.[53]

All the practices we have noted are equally familiar in North America. Spirits of the dead make men ill by spitting or blowing in their faces; and the *shaman* would cure them by the same process.

Huichol worshipers purifying themselves before Grandfather Fire hold out their palms to him, then spit on them and rub quickly over their joints, legs and shoulders. Shamans follow the same method in healing. If deer hairs, foretokening success in the hunt, are found in the grass gathered for thatching the fire-temple, the shaman graciously spits on them before returning them to the lucky finder. When straw effigies of opossums are placed on the conical roof as guardians of the temple, the shaman and his assistant spit on them repeatedly and prayerfully. When placing a "prayer stone" on a wayside cairn to gain new strength for the journey, the person placing it first spits on it. When some one has been made sick through witchcraft, the doctor finds out the sorcerer and comes to terms with him, and the sorcerer makes himself invisible and goes to the patient and rubs spittle in the armpit, thus curing him.[54]

In Europe also, survivals of various uses of spittle in

[50] *Arabia Deserta*, I, 527; II, 164.

[51] Peters, *Nippur*, I, 350.

[52] Hesse-Wartegg, *Tunis*, 253.

[53] *Folktales of the Magyars*, LXV.

[54] Lumholtz, *Unknown Mexico*, I, 381; II, 40, 41, 239, 265, 267, 282, 354.

healing are known. Black[55] cites its usefulness against the evil eye, as a cure for warts, as an ingredient of salves, as part of the cure for gout or rheumatism, for healing sore eyes, and as an agency for killing scorpions among various peoples—some of these prescriptions being with incantations and some without.

V.

Adding to this widespread primitive reverential spitting and its use in healing, the equally wide-spread theory of disease, and we have the key to the notion of contempt associated with spitting among more advanced peoples. Since all disease is caused by evil spirits the healing by spittle is directly a rite of exorcism, and where mystic spells are read for the purpose of healing they may alternate with spitting.[56] So in China spitting on the sick, on those in a swoon or mad, is an excellent way to expel the obsessing spirit or indwelling specter. Or the performer may blow upon them, or spirt water upon them, preferably in the face.[57] Slatin Pasha[58] tells how a Bornu doctor undertook to cure his headache by pressing the temples with thumb and forefinger, muttering pious texts and spitting in Slatin's face, getting knocked down for his pains by the unappreciative patient who could not understand that the disease was the work of the devil who must be driven out by spitting. Thompson reports a rite of exorcism witnessed at Mosul: a knife was laid on the patient's head, dates were brought in and fumigated with incense during the incantations, the magician then spit upon them and gave them to the patient to eat.[59] This was probably sending into the man a more powerful spirit to expel the mischievous intruder.

[55] *Folk Medicine*, 184-5.
[56] Doughty, *op. cit.*, I, 314.
[57] De Groot, *Religion of the Chinese*, 54.
[58] *Fire and Sword in the Soudan*, 25.
[59] *Semitic Magic*, 107.

Spitting at a passing jinn, or at an obstinate lock, already mentioned, may be compared with the Danakil belief. A camel having gotten loose in the night, the Danakil owner concluded that the devil was in the cord with which the animal had been tied. So the cord was rolled in the hands while spells were muttered, and the cord was spit upon at the close of each spell. The devil having unquestionably been expelled, the cord was delivered to a lad to seek and bring back the lost camel.[60] But the European unbeliever is sure to suffer many things among people who hate the devil so heartily. Mrs. Stevens tells us that a devout Soudanese Mohammedan, compelled by the infidel Frank to cook swine's flesh, was discovered devoutly spitting upon the accursed ham, before bringing it in to breakfast.[61] In the same kitchen a cook who sometimes frothed at the mouth was so completely under the control of a demon that his frightened fellows unskilled in exorcism dared not enter the kitchen, but stood outside till he handed them the finished dishes.[62] More fear and less esteem of spirit obsession is apparent here than in Palestine or Arabia.

In the same class with exorcism of evil agencies by spitting is the destruction of them by the same means. Folk-tales abound in such instances. In Japan we find the legend that when the great teacher Kobo Daishi was attacked by a dragon, he spat upon it and killed it.[63] In Morocco "not long ago, when swarms of locusts ravaged the gardens of Tangiers, the shereef of Wazam expelled the intruders by spitting in the mouth of one of them."[64]

But where the notion of healing by spitting becomes dominant, and the spitting salutation yields to other conventions or is slightly modified, the formal spitting upon

[60] Harris, *Highlands of Ethiopia*, I, 247.
[61] *My Soudan Year*, 29.
[62] *Ibid.*, 31.
[63] Lloyd, *The Creed of Half Japan*, 245.
[64] Westermarck, *Origin and Development of Moral Ideas*, 255.

a healthy person comes to be construed as an accusation of secret illness, sorcery or demon possession, and as such is promptly resented. It is familiar in Africa that a "witch doctor" makes his accusation often at the peril of his own life and must immediately flee from the fury of the accused party and his family. This is characteristic of only the more advanced stages of culture, however. The universal prejudice against an alien or stranger, or one of another cultus, makes all such to be construed as unclean, spirit-possessed persons, and prophylactic spitting and muttering of prayers, curses, or spells, is resorted to by those who think themselves in peril.

Thus in New Guinea certain tribes disinfect a party of suspicious strangers by whispering or muttering an incantation over the branch of a tree, striking each visitor on the back with it and spitting upon him, then burying the branch.[65] The rite naturally becomes associated with the feelings of the spitter, and the supposed uncleanness or inferiority of the person spit at. This explains the curious mingling of customs in Semitic lands, for instance. In Is. l. 6 the exiled servant of Yahveh says he "hid not his face from shame and spitting," yet in Babylonia, as already cited, the priestly exorcist acquired his powers by having his own mouth spit into. So in Numbers xii. 14, Miriam is spoken of as liable to be thrust out of camp seven days if her father had spit in her face; but this probably does not mean that she is defiled by such spitting, but that such spitting is an announcement that she is defiled or obsessed by some spirit, the spitting being part of the exorcising rite. So also the *levir* who fails in duty is probably defiled thereby. Does the injured party cleanse him? (Deut. xxv. 9).

The mixed association remains to this day throughout all Semitic peoples, as already shown. One may spit at

[65] Frazer, *Taboos and Perils of the Soul*, 109.

a Frank as a mark of horror, fear, or contempt, or he may bring his child and request the Frank to spit upon it. All depends upon the personal estimate of the Frank prevailing at the time. The protective powers of spittle are the same in either case. Quite curious to us seems the fact that the familiar institution of *dakhil* or "taking refuge" with a powerful protector may take the form of spitting upon him, if he pass near enough to the suppliant.[66] It was probably a formal blessing or solemn adjuration of primitive times, to which the party appealed to dared not be indifferent The same institution is found in Central Africa. Among the Bambarra a condemned criminal is safe if he can spit upon a passing chieftain, and the latter must thereafter support him as well.[67]

VI.

That attention should be given to the probably ceremonial cleanliness of the person spitting is a clear and logical inference from the data cited. This is true in the Old Testament. There is no Levitical regulation against spitting in general, nor any intimation that all spittle is unclean, but an unclean person cannot spit upon a clean one without rendering him unclean (Lev. xv. 8). His spittle is temporarily impure. Catarrhal spittle is widely deemed unclean. The Babylonian priestly exorcist already cited claims that it is the "pure" spittle of Ea that has inspired him. Gudea, in one of his inscriptions, says that in his religious purifications he gathered up the impure spittle from the streets. A modern board of health would gladly give him employment. In a curative incantation over a dough figure, a Babylonian exorcist says,

> "That the spittle which has been spat
> May be poured forth like water,

[66] Layard, *Discoveries in the Ruins of Nineveh and Babylon*, 317.
[67] Westermarck, *Op. cit.*, II, 637.

That the magic(?) which mingled with the spat forth spittle
May be turned back."[68]

This may possibly mean that the evil effects of the spittle that wrought the mischief were due to its impurity; but it can not be certainly maintained. Shylock says to Antonio, "You did void your rheum upon my beard"; suggesting that Shakespeare knew the peculiar uncleanness of catarrhal spittle. Marcellus gives a cure for sore eyes, in which the mere spitting has acquired special precautions. Take the saliva of a woman who has born only male children, and has abstained from cohabitation and pungent foods three days. Then, if her spittle is bright and clear (not catarrhal) anoint the diseased eyes with it, and they will be cured. In modern Italy you must take the saliva and some of the milk of a woman who has born a seven-months child and anoint the sore eyes with the mixture, make the sign of the cross on the eyes, then spit thrice behind you, repeating a certain formula as you anoint. This must be repeated three mornings fasting. Again in a cure for gout, given by Marcellus, it is said "Poison is conquered by poison; fasting spittle can not be conquered." The healer must say this thrice, and spit each time on the soles or footprints of him who is to be cured. The spittle of a boy baby is in another formula prescribed as sure to be clean and pure, and it is used in the same way.[69]

VII.

It will be recognized that it is not possible in considering the mass of surviving spitting rites to point out unerringly the exact stage of thought or custom in which a given ceremony arose. For instance, cases already cited of spitting in connection with a prayer or desire to be avenged on one's enemy are slightly different from the

[68] Thompson, *The Devils and Evil Spirits of Babylonia*, 108.

[69] Leland, *Etruscan-Roman Remains*, 279-80; 296-97.

spitting of exorcism at a suspicious stranger. The first may be a primitive form of worship of a higher power, while invoking aid; the second may be only reliance upon some supposed mysterious powers of the saliva. Yet either may explain the custom of spitting on hearing the mention of a name or a deed of ill omen. In Scotland, for instance, some family names are names to spit at, and quite frequently it does not imply clan feud or personal hatred.[70] An Australian black may spit excitedly, if he learns he has inadvertently mentioned the name of a dead person; an Abyssinian may strive to spit and scrape off his tongue an oath he wished to abjure; and I have known an English miner to spit excitedly at unwelcome news or names. With the spitting of imprecation would be classed the Ovambo habit of cursing or bewitching an absent one by gazing at a pool of water (crystal-gazing) until the form of the man appears—then spitting at it and pronouncing the curse.[71] The other African data suggest that the spitting here is an invocation or obeisance to the patron ancestor. Invocation of a primitive earth-mother appears in some African religious rites and folk-lore, so that the belief that a rain-maker can raise a storm by spitting on the ground[72] would appear to belong to that type.

Exorcism again is suggested by the Atlas Berber who spat upon the coin Professor Westermarck gave him, to counteract the effect of any evil magic that might be in the Frank's coin.[73] But in northern Europe the fear of ill luck or misfortune takes the particular form of fear of losing that coin. So in northern England any money supposed to be received from a witch must be put into the mouth, or else the witch may spirit it away, and leave only a stone in its place. Another form of statement is that if

[70] *Folk-Lore*, VI, 170.
[71] Frazer, *Magic Art*, 163.
[72] Callaway, *op. cit.*, 409.
[73] Westermarck, op. cit., I, 594.

you spit on the first money you receive in your day's trading, you will be lucky in the day's business.[74]

This notion that productive power is imparted by spittle has an amusing illustration in Mr. Thomson's experience in Masai Land.[75] The natives were greatly impressed with the strange white man and his powers, and at length an elderly important fellow came with his young wife and stated that they had decided that it would be a fine thing to have a little white boy of their own. Thomson argued that it was best to leave such things to Ngai (god, or patron ancestor). But they made it plain that they had much more confidence in him than in Ngai. Thomson got out of his difficulty by administering a magic potion, effervescing fruit salt, and spitting liberally all over the would-be mother. His friendship being demonstrated in orthodox Masai fashion, his fame spread, and his spitting powers were sorely taxed during the remainder of his stay in the land.

Creative power turns up in some later myths and folklore; as in India, for example. Agni, the fire-god, is said to have tried to conceal himself in the waters. Failing in this, he spat upon them, and three divinities sprang forth. Another legend of Tvashtri, the creator of seed, declares that he spat upon the head of a sacrificial victim, and that his spittle because the brain, and the marrow of the neck-bone, which some Hindu theories identify with the soul or spirit.[76] It would appear that in ancient India, as in modern Africa, spitting on the head of a sacrificial victim was a familiar custom.

From some of the data considered, the question is fairly raised whether spitting salutations are not the ancestor of kissing. This latter custom is far from universal. It is

[74] Henderson, *op. cit.*, 32, 181.
[75] *Through Masai-Land*, 288-290.
[76] *Sacred Books of the East*, XII, 47; XXVI, 266.
[77] *Savage Africa*, 163.

not an African custom, where spitting salutations are prevalent and protruding lip and nose rings common. Reade tells us an amusing story of a negro princess's fright at being kissed the first time. She imagined this strange wetting with the lips was preparatory to devouring her.[77] East African pledges of friendship or brotherhood we have seen may take the form of spitting in each other's mouths, while a "holy" Arab may spit in the mouth of a neophyte, which custom reappears in some old rituals in the Christian church as kissing the neophyte. A friend who has taken part in American Indian dances tells me of some in which the dancers are paired, each carrying a pebble in the mouth which at a given stage of the dance the partners exchange. The spectators would call it kissing, though the red man as a race is not a kissing animal. In the salutations of the moon, previously mentioned, spitting in the hand and waving at the moon seems identical with kissing the hand to the moon; or, as I have seen spitting over the right shoulder on seeing the new moon. So the kissing of "peace" between two Arabs who meet may be the direct descendant of the exchange of spittle between two covenanting savages. Animals may have taught man something worth while, though the process was a long one!

Another by-form of this primitive salutation and mode of healing probably exists in the world-wide practice of shamans and magicians of "sucking out" a disease, exhibiting then some object as proof of their powers. To the primitive patient the power of a holy man's spittle is irrefutably demonstrated by such tricks. The American boy is not the first who has spit upon his bait in hopes of piscatorial success, and the modern mother who says to her child "Let me kiss it to make it well" has at least the authority of an immemorial past for her proposal.

THE CHEMICAL ORIGIN AND REGULATION OF LIFE.

INTRODUCTORY.

THE last years of the nineteenth and the first of the twentieth century, which have constituted a period of tremendous progress in physical science, have unfortunately witnessed a recrudescence of that "cult of incompetence" in biology, *vitalism.* Neo-vitalism, under the leadership of Driesch[1] in Germany and of Bergson[2] in France, asserts that the phenomena of life are not determined by law-abiding forces, but by a form of activity the effects of which are unpredictable, and which, consequently, must be regarded from a formal point of view as chaotic and beyond the range of science.

It is the purpose of the present paper to combat the thesis of the new vitalism by showing how a single physico-chemical conception may be employed in the rational explanation of the very life-phenomena which the neo-vitalists regard as inexplicable on any but mystical grounds. This conception is that of the *enzyme*, or *organic catalyst,* and it is the belief of the writer that the conception in question, with its physical and chemical corollaries, will ultimately prove adequate to the resolution of at least five fundamental mysteries of vital behavior: (1) the origin of living

[1]Hans Driesch, *The Science and Philosophy of the Organism,* 1908, 2 vols. Also, *Die "Seele" als elementarer Naturfaktor,* 1903.

[2]H. Bergson, (Engl. trans.) *Creative Evolution,* 1911.

matter, (2) the origin of organic variations, (3) the ground of heredity, (4) the mechanism of individual development, and (5) the basis of physiological regulation in the mature organism. It is perhaps needless to say, however, that only a very meager idea of the manner in which the enzyme concept can be applied in the solution of these problems can be conveyed within the limits of a single article, and, accordingly, the writer hardly expects to satisfy all of the demands and arguments of neo-vitalism in the present paper. It must suffice here to suggest lines of thought which may later be developed more extensively.

A word should be said at the outset concerning the method and point of view of the discussion which is to follow. This discussion will present no new experimental facts; it will rather compare and unite a number of such facts, which are common knowledge to all biologists, in an attempt to build up a consistent and coherent theory of the experimental field in question. Our method, then, will be *synthetic,* or inductive in the true sense of the word, instead of being strictly empirical. Very few theories can be directly verified by the observation of nature; the best one can say for a scientific hypothesis is that it is in harmony with the facts, and this harmony is what constitutes explanatory power. That the theory of enzymes is in harmony both with the phenomena exhibited by living organisms and with the principles of chemistry and physics we shall attempt to demonstrate, so far as is possible within the limits of a brief discussion; but we cannot hope to show that it is an accurate representation of reality, for this is too much to ask of any scientific theory. The only original merit which the writer cares to claim is that of seeing and recording the perfectly obvious relationships of things, when his colleagues have failed to see or else to record them.

THE ENZYME AS A CHEMICAL REGULATOR.

Modern vitalism, like its progenitors, is dualistic. It asserts that living matter is the product and expression of two fundamentally independent forms of existence, the physical and the vital. And the first difficulty which vitalism raises in the path of scientific progress in the study of life is that of the process by which protoplasm was first generated from inorganic substances. Under present conditions living matter is formed from the non-living only under the influence of other living matter; but if the mechanistic theory of life is to hold we must suppose that this has not always been the case and that far back in the past there was a time when organic bodies were formed spontaneously from dead and unorganized matter. The vitalist maintains that such a spontaneous change is inconceivable and that in order to account for the origin of living organisms one must invoke the activity of a special *regulative principle*, which even in the first instance limits and directs the mutations of physical substance so that vital phenomena at last appear. But the objections which can be made to the physico-chemical interpretation of life do not end at the beginning; simple protoplasm must be developed into complex and varied organisms, each capable not only of propagating its kind but also of giving rise to new species which shall constitute improvements upon the old.

Neo-vitalism tends for at least two reasons to reject the Darwinian doctrine of evolution by natural selection, which was formerly considered adequate to the explanation of tribal development. The first is the admitted failure of the mechanistic school of biologists to account for the *origin of variations*. Darwin referred to variations—which form the *sine qua non* of natural selection—as accidental, but qualified this reference by stating that he did

not actually regard them as accidental but as due to unknown causes.[3] The modern vitalist emphasizes the unfortunate fact that these causes are still unknown. The second reason which neo-vitalism advances for its rejection of the Darwinian theory lies in the alleged fact of the *purposeful character of variations*: it is asserted that the changes which take place in the propagation of a species are not haphazard in distribution but manifest a definite teleological trend. This, say the vitalists, is due to the regulative influence of the vital force, which is also the cause of variation in general.

Mechanism in biology not only fails, in the mind of the vitalist, to account for organic variations, but it also fails, curiously enough, to explain the facts of heredity; it is inconceivable that the tiny germ-cell should contain a physical machine which shall be capable of constructing the living organism with the wonderful accuracy which is actually manifested in embryonic development. The organism is too intricate, and the raw material too indifferent to permit one to refer the elaborate processes of ontogeny to a mechanical contrivance contained within the germ; the relationship of heredity can only be accounted for by calling in a special vital principle which here, as in the pristine beginnings of life, serves to regulate the physical and chemical forces which impinge upon the germ-cell, and which thus engineers the changes by which the mature organism is built up. The necessity of postulating such a regulative force, outside of those of ordinary matter, is proven not only by the remarkable uniformities which are observable in the structure of individuals of the same species, but also by the ease—one might almost say the dexterity—with which the constructive process overcomes obstacles which are placed in its way. Cut a partly developed embryo in two and it will still produce a perfect organism. Purpose-

[3] C. R. Darwin, *The Origin of Species*, 1859, Chap. 5, pp. 131-171.

ful adaptability of this sort can hardly be consistent with the mechanical regulation of development, but it is quite conceivable in connection with the operation of a semi-conscious vital energy which possesses properties resembling foresight and calculation.

Difficulties of a similar nature are raised by vitalism against the physico-chemical theory on the basis of normal physiology, in which there exist many cases of special organic regulation which are asserted to be inexplicable as the effects of mechanical forces acting under purely mechanical conditions. Such functions as the "regeneration of lost parts" and the general phenomena of "animal behavior" are said to demand a non-mechanical explanation. They present a type of regulation foreign to that exhibited by any physical substance.

It would seem, then, from the above review of the objections which the neo-vitalist raises against our acceptance of the physico-chemical theory of life, that these objections may be reduced to the problem of discovering a physical or chemical conception capable of accounting for the observed facts of organic regulation. Regulation seems to be the most striking active characteristic of living beings. The word "regulation" is here employed to denote the power which is shown by organisms to reach their apparent ends more or less independently of the environment in which they are placed, in fine, their capacity to neglect or leap over the difficulties which may be thrust in their way.

The necessity for such regulation first appears in connection with the problem of the origin of life. In order that the multitudinous and chaotic chemical changes taking place in the primeval oceans should have resulted in the production of definitely localizable and individual masses of even simple protoplasm, there must have appeared some regulative force which could limit or encourage these reactions in special directions, and which could maintain

the individuality of the protoplasmic masses throughout long periods of continuous growth and repeated subdivision. If this regulative principle were embodied in a definite chemical substance or substances we might expect that the accidents of the process of its reproduction would lead to disturbances of its original nature, and to the consequent appearance of variations in the constitution and functions of the living bodies whose characters it served to determine.

This failure of the regulative principle to act with complete perfection would bring into the field of the struggle for existence new forms of regulation, which, if they happened to mediate valuable structures or activities, would be preserved and become the basis for further and more elaborate differentiation by the same method. The sum of all of the regulative substances thus established within the organism would constitute the physical ground of heredity and of embryological development,—a relation and process which is *par excellence* regulative in nature,—and these same physical determinants, arriving finally by their own efforts at the stage of mature or adult organization, would be capable through their regulative capacity of superintending the normal activities and special adaptations of the fully developed living being. However, in this final stage of their function, as in the first, the material regulative principles must not be expected to remain entirely uninfluenced by the disturbing physical and chemical forces which are more or less accidentally brought to bear upon them in the course of their regulative activity. Hence it may be that some features in animal, or even in plant behavior will present that same aspect of variability which appeared in the case of primitive development, and throughout the evolutionary process.

Regulation is essentially a selective activity. Out of a multitude of possible chemical and physical reactions the

living organism selects only those limited few which correspond to what we call its "needs" or "purposes." Whether the meaning which we commonly attach to these words is at all significant from the point of view of science is a question, but whatever the case may be it is obvious that if we can exhibit a general and adequate chemical basis for such control we shall have smoothed out many of the difficulties which are faced by the mechanical theory of the nature and origin of living forms. This is the task which now lies before us.

The fact that all vital activity involves chemical change —and, if it is to be accounted for in naturalistic terms, must be supposed to derive all of its energy from such change—makes it necessary that we look for *a material principle of regulation having an essentially chemical nature and function.* Since it is our thesis that the enzyme constitutes such a principle, and one which if properly applied will dispell the fundamental difficulties raised by vitalism in the face of the physico-chemical theory of life, it becomes necessary that we devote a few words to the enzyme *per se.* The enzyme is an organic catalyst, and a catalyst is a substance which by its mere presence in a mixture is able to facilitate and direct the chemical changes there taking place. This directive power of a catalyst resides wholly in its singular ability to accelerate the so-called reaction velocity of specific chemical reactions.

It is a fact well known to students of chemistry that every such reaction possesses a characteristic "rate" which is constant for constant conditions of temperature, pressure, concentration, and the like. But all chemical changes appear to occur in the face of forces of resistance, which are at least comparable with friction in the case of mechanical motions, and the greater the chemical friction, the slower, of course, is the "rate" of the corresponding reaction. Now the mechanism by which catalyzers are able to accelerate

or hasten reaction rates consists apparently in a reduction of the chemical friction. The catalyzer is a sort of intermolecular lubricant, which oils a specific reaction; it cannot assist the change by any energy of its own because it does no work, and remains unaltered at the end; rather, as the derivation of its name would indicate, it operates by freeing the molecules from their chemical chains and permitting the reaction to "slide." Every chemical change seeks a definite level; whether that level is found in a minute or in a century may be determined by the presence or absence of the appropriate catalyst.

Catalysis is not a mystical process. Although up to the present time no precise hypothesis has been advanced to elucidate its mechanism, this is due to lack of interest in the problem rather than to the impossibility of its solution, for the modern electrical theory of the constitution of matter suggests an explanation which is at once simple and in harmony with all existing physical and chemical principles.

The reduction of chemical friction by the presence of catalysts is so marked that reactions, such as that between cold oxygen and hydrogen, which without the catalyzer (platinum) would require thousands of years for their completion, may, with it, be finished in very short order. And to accomplish this catalytic lowering of the chemical resistance it is not necessary that very large amounts of the liberating substance be present; the effect—upon the decomposition of hydrogen peroxide — of finely divided platinum at a concentration of one part in three hundred million, is easily detectible. But small as is the quantity of catalyst which is thus effective, it could, theoretically, be entirely recovered from the solution at the end of the reaction, no matter how much peroxide had been decomposed or how long the reaction had been in process.

The relevancy of the peculiar properties of catalysts—

and in particular of enzymes—to the solution of the biological problems which we have been considering will appear more clearly as our discussion proceeds. It happens that chemical friction—which, we have said, is lowered by catalysts—is conspicuous in almost all reactions into which the compounds of carbon enter, and as everybody knows, it is carbon which constitutes the chemical basis of life. Accordingly, we should expect to find that the manifestly active nature of living beings is dependent upon catalytic processes, and this expectation is verified by empirical research. The presence of a specific catalyzer, or enzyme, in a complex solution of organic substances such as is given in protoplasm will obviously have the effect of accelerating that particular reaction with reference to which it is specific, while the other changes remain uninfluenced. When, as is the case with most organic reactions, the original changes are so slow in rate as to be practically negligible, and the specific acceleration produced by the enzyme is considerable, the effect of the latter will be to all intents and purposes the same as if it actually carried with it into the chemical arena, previously empty of change, a specific activity.

It is clear, then, how by their mere presence in complex mixtures, especially of organic compounds in solution, catalysts can exert a positive control over both the qualitative and quantitative nature of the chemical reactions which may occur in these mixtures. Since protoplasm is just such a solution as this, and since the fundamental changes taking place in living matter are chemical, the "regulative principle" which we have in our previous discussion found to be required by the most general facts of biology, may obviously be identified with the catalyst; and in this identification we shall provide a complete general basis for the explanation not only of the phenomena of regulation them-

selves, but of those deviations from regulation which appear in evolutionary and individual progress.

THE ENZYME AS THE CREATOR OF LIFE.

Extant theories with regard to the origin of life agree that the birthplace of living forms was the primordial ocean. In Paleozoic times the seas were universally warm, and were kept in this condition by the blanket of water-drenched air which sheathed the earth. The high concentration of carbonic acid existing in these early oceans was another factor which must have favored the original production of protoplasm, a substance fundamentally aqueous in its constitution and which even at the present time contains essentially the same variety and relative proportions of inorganic salts as are found in the sea. The idea that the primeval oceans were the cradle of life is not inconsistent with vitalism, for since life processes must have a physical substance, this substance might with all appropriateness be drawn from the warm waters of the early seas by the initial efforts of the vital force. It has been suggested, however, by Richter,[4] Arrhenius,[5] and others that the spores of life may have been transmitted to the earth within the cores of meteorites or under the pressure of starlight, an idea which enforces the conception of a permanent dualism between the living and the non-living. On the mechanistic side the theory has been advanced by Pflüger[6] that the first forms of living matter were based upon the compound cyanogen, but it is difficult to see how, upon Pflüger's hypothesis alone, this primitive protoplasm was able to reproduce and maintain itself when once formed, or how a sufficient

[4] H. E. Richter, "Zur Darwin'schen Lehre," Schmidt's *Jahrb. d. ges. Med.*, 1865, cxxvi, p. 243.—"Bericht über medicinische Meteorologie und Klimatologie," *ibid.*, 1870, cxlviii, p. 57.—"Die neueren Kenntnisse von den krankmachenden Schmarotzerpilzen," *ibid.*, 1871, cli, p. 313.

[5] S. Arrhenius, *Worlds in the Making*, 1908, Chap. viii, pp. 212-231.

[6] E. Pflüger, "Ueber die physiologische Verbrennung in den lebendigen Organismen, *Arch. f. d. ges. Physiol.*, 1875, X, p. 251.

amount of it to make up even a minute living body came to be produced at any one point.

It would be inconsistent with the general principles of evolutionary theory to suppose that protoplasm as we now know it came into being by any instantaneous process of creation; primitive living substance must have been something much more closely akin to ordinary inorganic matter than is protoplasm as we find it to-day. But primitive protoplasm must have possessed at least some of the characteristic vital properties; it must have been capable of growth and must have exhibited a certain selective activity with reference to its environment.

It is probable that the substances necessary for the original production and the nutrition of such a primordial life-form were present in the ocean-waters in rather high dilution, and there can be little doubt that the chemical changes which were requisite in order that these substances should be transformed into the native material of the organism itself were not such as could be counted upon to take place spontaneously with an appreciable rapidity. There is thus no guarantee that a rudimentary protoplasm, once formed, would exhibit the phenomenon of growth, except by virtue of some inherent properties of its own.

A little reflection will serve to show that if we are not diffident in our application of the conception of catalysis it will provide us with an explanation of life from the very start. Let us suppose that at a certain moment in earth-history, when the ocean waters are yet warm, there suddenly appears at a definite point within the oceanic body a small amount of a certain catalyzer or enzyme. Let us, moreover, imagine that the sea-water contains in solution a number of substances which react very slowly to produce an oily liquid, immiscible with water. A reaction of this character based upon probable solutes of the early seas might easily be specified. Now in the third place, we must

imagine that our enzyme is related with this reaction in such a way as greatly to reduce the chemical friction which it encounters, and hence markedly to increase its rate. What will be the outcome? Why, obviously the particle of enzyme will become enveloped in the oily material resulting from the reaction, and if it happens that the original substances which enter into combination are soluble in the oil as well as in the sea-water, the little oil drop will wax greater until it is split up into smaller globules by the natural currents of the ocean. It is clear that the developing oil drop is intended to represent the origin of the first and simplest life-substance. But protoplasm, however undifferentiated, must possess the power of indefinitely continued growth, a characteristic which is apparently lacking in our oil drop, for the reason that repeated sub-division will finally exhaust the original quantity of catalytic material which is present, and which is responsible for the growth process.

We have said that enzymes, and catalysts in general have the power to assist in the production of specific chemical substances. Now there is no reason why the same enzyme should not aid in the formation of more than one substance and also why one of these substances should not be identical with the enzyme itself. A process of the last mentioned variety, in which the presence of a catalyzer in a chemical mixture favors the production of the catalyzer itself is known as *autocatalysis*. Many instances of autocatalysis have been discovered in the field of inorganic chemistry so that it cannot be regarded as in any sense a vitalistic phenomenon, although we shall find the relationships which it involves to be indispensable in the chemical explanation of vital events. This will be made evident by the manner in which the conception of autocatalysis removes the difficulties faced by our theory of the origin of protoplasm. In order that the primitive life-substance,

whose original formation we have described above, should be capable of continuous growth in all of its sub-divisions it is only necessary that the enzyme about which it centers should be autocatalytic, as well as effective in the production of primitive protoplasm. In this case each new globule which is formed from the original one may carry away with it a quantity of enzyme sufficient to permit its continuous growth and reproduction.

The theory of the origin of life which we have briefly outlined above, and which is to be extended as our discussion proceeds, satisfies most of the objections which have been advanced against the ordinary chemical hypothesis. The characteristic catalytic power of the enzyme accounts for the elevation of the rate of the synthetic reaction from a practically null figure to one making possible rapid growth of the protoplasmic mass. The same catalytic property explains the localization of the reaction in a definite region, for catalysis can occur only where the catalyzer itself is present. The theory also provides a basis for the permanent growth of the primitive organism—if such we dare to call it—as well as for its reproduction, without, in general, the loss of its specific individuality.

The most fundamental objection which can be raised against the theory has reference to the source of the original enzyme. This enzyme is a very special sort of body, and consequently its fortuitous formation in the primeval oceans may be regarded as an improbable event. However, this is not equivalent to saying that it was an impossible occurrence, and since only one event of this specific kind is required by the theory during a period of time covering many millions of years, objections based upon general considerations of probability have practically no force. Chemistry must answer the question as to whether our first enzyme is possible. A very great number of different compounds must have been formed as a result of the multi-

tudinous chemical reactions which undoubtedly took place in the primordial oceans, and there is no reason why one of these compounds should not have been just the body required to mediate the origin of living matter. The striking fact that the enzymic theory of life's origin, as we have outlined it, necessitates the spontaneous production of only *a single molecule* of the original catalyst, renders the objection of improbability almost absurd.

Now although the primitive living bodies whose hypothetical origin we have above described possessed the characteristic vital power of propagating their kind by indefinitely repeated processes of subdivision, they cannot be regarded as living in the full sense in which this term is applied to the complex substance of animal and plant cells. Primitive protoplasm was probably an almost pure chemical compound; evolved protoplasm, on the other hand, is characterized by its very lack of chemical unity. Contemporary general biology is largely a development of the conception of "simple protoplasm." But "simple protoplasm" is not simple; it is a complex, a structure, a mixture; and if we are evolutionists we cannot admit that such a substance is the ultimate ground of biological thought. "Simple protoplasm" must have a chemical history, must have been built. In the following section of this article we shall consider the process by which in accordance with the theory of enzymes, primitive protoplasm may have developed into the more advanced type now familiar to biologists. It suffices at this point if we have shown that the regulative principle of life which vitalism asserts must have existed prior to all concrete vital phenomena was not necessarily immaterial in its substance. That control of self and of environment, which the vitalist rightly regards as its defining feature, appertains to life only by virtue of the store of *enzymes* which is hidden away in protoplasm, and when one of these enzymes first appeared, bare of all body,

in the aboriginal seas it followed as a consequence of its characteristic regulative nature that the phenomena of life came too.

THE ENZYME AS THE BASIS OF EVOLUTION.

In spite of the great prestige of the Darwinian theory of organic evolution, many neo-vitalists have not hesitated to assert that this theory will soon be regarded as a matter of historical interest only. The doctrine of the development of adaptive forms of life by accidental variation and natural selection—which was advocated by Darwin—seems to be the only conceivable hypothesis which is capable of explaining the origin of species in a mechanistic way, and yet it cannot be denied that this doctrine has recently met with reverses. The most important of these lies in the inability which is exhibited by its principal exponent, August Weismann,[7] to account in physical and chemical terms for the origin of variations. Darwin himself left this problem to be solved by his successors, with the single suggestion that variation might be due to an inheritance of acquired modifications. The mechanistic theory of heredity, as formulated by Weismann,[8] renders this suggestion abortive, and the alternatives of "amphimixis" and "germinal selection" which have been proposed seem upon analysis to be merely methods of begging the question. But there can be no doubt that variations do occur, and since no satisfactory physico-chemical explanation of their origin is forthcoming, the vitalist naturally propounds one which is in harmony with his own presuppositions, and then he proceeds to strengthen his vitalistic doctrine by showing that variations are in many cases distributed according to purpose rather than according to chance.

[7] A. Weismann, (Engl. trans.) *The Evolution Theory,* 1904, 2 vols.

[8] A. Weismann, (Engl. trans.) *The Germ Plasm,* 1893.

The so-called "orthogenists"[9] find a consistent teleological directioning of variation in the evidence both of paleontology and of the modern statistical study of the grounds of evolution, a discovery which is at least formally in agreement with the Lamarckian—and anti-mechanistic—principle of development through a more or less purposeful effort on the part of the individual organism. The De Vriesian "mutation theory"[10] is also taken by some vitalists to represent an anti-Darwinistic movement, and indeed in a certain sense this is true, but—as we shall endeavor to demonstrate—the mutation theory is not inconsistent with the mechanistic view of organic nature, and may even be considered more in harmony with modern physico-chemical ideas than is the original doctrine of Darwinism.

Neo-Darwinism—which to-day opposes the vitalistic view of evolution—insists upon the primary irrelevancy of the character of variations to the demands, purposes, or needs of the varying and developing organism, and maintains that the fact of adaptation is to be explained only by reference to the "survival of the fittest." All species are subject to repeated and excessive multiplication, the individual exemplars of the species exhibiting variations from the type which are due in all significant cases to "spontaneous" alterations in the constitution of the determining germ-plasm, and which, in general, possess no predominating tendency either to assist or to injure the welfare of the organism, if anything rather the latter than the former, since there are more unfavorable possibilities than there are favorable ones. Since the original variations occurred in the constitution of the germ, and only secondarily in that of the individual organism, there is every reason why they should be reproduced in the ensuing offspring of the same germinal material. Those organisms

[9] Cf. G. H. Th. Eimer, *Organische Evolution*, 1890; and E. D. Cope, *The Primary Factors of Organic Evolution*, 1896.

[10] H. De Vries, (Engl. trans.) *Species and Varieties*, 1905.

possessing germinally determined characters which unfit them for survival will perish, and with them the malforming germ-plasm, so that at any time in the history of living species there will be a great preponderance of adaptive over non-adaptive organic forms. This is the essence of the mechanistic theory of evolution, a theory the critical weakness of which lies in its failure to account for the origin of variations.

Probably the greater number of the modern objectors to Darwinism would admit the validity of the process of development which it represents, provided only it is legitimate to adopt three fundamental hypotheses: first, that the germ-plasm actually and inevitably determines individual characters; second, that spontaneous variations in the constitution of this germ-plasm do occur and thus necessitate parallel variations in the corresponding individuals; and, third, that these variations are of such an order of magnitude as to bring about considerable differences in the adaptation of the individuals in question to the conditions of life. The dispute concerning the validity of Darwinism rests, then, upon a disagreement with reference to the ground of heredity, and more especially with regard to the possible occurrence of large and frequent spontaneous changes in the exact character of this ground —if it be material—in particular cases of descent. In a word, the solution of the vitalistic difficulties in the field of evolutionary theory will be provided in *an intelligible physico-chemical hypothesis capable of explaining both Mendelian inheritance and De Vriesian mutations.* It is our thesis that the theory of enzymes meets the requirements of this situation.

Our theory of the beginnings of life, which we have outlined in the preceding section, demands that primitive protoplasm should be composed of a single chemical substance which can be formed from the reagents present in

the waters of the primeval oceans, by the intermediation of a specific *enzyme,* which latter is at the same time capable of bringing about its own reproduction by a similar, but *auto*catalytic process. The possibility and probability of the appearance in the early seas of an enzyme of this character have already been sufficiently debated. "Primitive protoplasm" was far from being what we now know as protoplasm, and which, as has been indicated, biologists often erroneously regard not only as the present but as the historical basis of life; irritability and contractility with all of their refinements and combinations are evolutionary additions to the original physiology of the vital material, due to variation and natural selection. If this is true, we may study this evolutionary process at its simplest in the development of "primitive protoplasm" into the more complex living substance which we now know. The original enzyme was the outcome of a chemical reaction, that is to say, it must have depended upon the collision and combination of separate atoms or molecules, and it is a fact well known among physicists and chemists that the occurrence and specific nature of such collisions can be predicted only by use of the so-called *laws of chance.* This does not mean that the motion of the molecules is actually at random, but only that the conditions which govern that motion are so complex and so difficult to study that we have as yet been unable to analyze them.

Now the kind of molecule—or chemical substance—which is produced by any particular molecular collision must depend upon the nature of the molecules which originally collide and upon the force and direction of the collision, and these factors, in turn, so far as we are concerned, are referable to chance. Consequently we are forced to say that the production of the original life enzyme was a chance event. But once a single molecule of this enzyme was formed its very existence *increased the probability*

that further molecules of the same sort would be produced in the same locality; this is the meaning of autocatalysis. The autocatalytic process thus established does not, however, preclude the occurrence of further chance events of the same general kind as the one which produced the first enzyme; indeed, on account of the increase in chemical activity which it occasions the presence of the catalyzer decidedly favors such further events. Accordingly we have only to wait a sufficiently long time, and a second autocatalytic enzyme will appear, and this enzyme may furnish the basis of a new species of regulation in the substance which we have called primitive protoplasm, and which it was the sole duty of the original enzyme to synthetize from the oceanic solutes. The chemical reactions which are set up in the primitive living substance by the appearance of the second enzyme may be either favorable or prejudicial to its continued existence. In the former case the enzyme and the function which it subserves will be preserved by the action of natural selection; in the latter it will be destroyed together with all of those species of primitive protoplasm which contain it. In either event it constitutes a new biological variation, which, if favorable, provides the foundation of a new protoplasmic species. It would appear, then, that the *theory of enzymes provides a molecular basis for organic variation,* and as our discussion progresses it will become clear that this explanation is profoundly in harmony with the facts of biology, as well as with those of physics and chemistry.

Biometry demonstrates that the variability of organisms of a single species follows, in general, the law of error, a fact which clearly suggests, if it does not prove, that the factor controlling biological variation is that of chance, or the independent causal activity of a large number of separate material units. That variations should obey the laws of probability, and these only, is to be expected if the

theory of enzymes is true, if the chances of variation are identical with those of the production, within the body of living matter, of special types of enzymic substance. Differentiation is simply the outcome of a continuation of the same process of random collision and combination which resulted in the production of the original life-forming enzyme. Since the *reproduction* of the germ-plasm is a chemical process, it can occur only by virtue of the probabilities involved in a *molecular chaos.*

The conception of the molecular chaos is one which is fundamental in modern physics and chemistry, and is based upon the idea that the heat motions of the individual particles which make up a body are relatively independent of each other both as regards direction and velocity. This implies that from the standpoint of the situation as a whole the molecules move more or less at random. Chemical reactions of any specified sort occur simply because the appropriate molecules happen to collide at the right speed, with the right side chains pointed in the right direction. If we take a large number of molecules we can be sure of a uniform result in any instance of chemical reaction. But if we consider a small number there will be certain cases in which the right molecules will not properly collide at all, other cases in which only a few appropriate collisions will occur, and still others in which all of the encounters will be favorable. Now the primitive germ-plasm—the first enzyme—and the elements of the later germ-plasms which arise under its influence, are not made up of an enormous number of molecules. The individual determining elements probably do not contain more than a few thousand molecules apiece. Hence it follows that the chances of the molecular chaos cannot be relied upon invariably to assist the controlling enzyme in its own reproduction, or autocatalysis.

Under these conditions there will of necessity creep

into the germ-substance aberrant molecular formations, the presence of which will produce organic variations. Some of these new conditions will simply be negative, a failure of the original autocatalysis. Others, however, will be positive, the chance occurrence of rare orientations of colliding molecules causing the original enzyme to aid in the construction of new catalytic bodies, which may then become parts of a more complex germ-plasm; no enzyme can be regarded as absolutely specific in its catalytic relationships. Again, new enzymic substances may arise by the same process which produced the original catalyst of "primitive protoplasm," the simple uncatalyzed but fortunate collision of certain molecules contained within the living material. It should be kept constantly in mind that in the case of the production or reproduction of an autocatalytic enzyme a single molecular instance may determine a far-reaching series of chemical events; for the formation of a single molecule of such a substance by a type of collision which is perhaps very rare, will mark the only necessary beginning for a continuous catalytic reproduction of this substance, and possibly of others, throughout a period of indefinite length.

It is important to notice that the basis of evolutionary change which is provided by the theory of enzymes is one which supports an increasing complexity of germinal and organic characters. The variations which occur in the original germ-plasm do not involve the substitution of new germinal or enzymic elements in place of those already present, but consist rather in the *addition* of these new elements to the original ones. If these additions prove to possess catalytic properties which assist the organism in its struggle for existence they will be preserved; if not they will be destroyed by natural selection. But if they are preserved they will furnish the basis of an *added character* of the protoplasm and organism, for the *original* catalytic

substance—being present in relatively large quantities, and so not liable to be disturbed by chance failures in the autocatalytic reaction—must also be preserved by the same selective forces; both the varied and its variation will exist alongside of each other. In this way, as time goes on, the organic forms which exist upon the earth will tend to become more and more complex.

Another consideration which is of the utmost importance, and which again reveals the powerful explanatory nature of the theory of enzymes, is that all variations of the sort which we have discussed above must be looked upon as "mutations" rather than as of the "quantitative" or "Darwinian" sort. Certain modern students of the phenomena of heredity, such as Professor Johannsen,[11] have compared organic species to chemical compounds, and in making this comparison have designated them as "bio-types." A "biotype" seems to have the same individuality as has a specific chemical substance; different "bio-types" are separated from each other by definite qualitative intervals; in interbreeding they do not "mix" but maintain their identity, and if we are to accept the teachings of De Vries we must suppose that their origin is also characterized by discontinuous qualitative change, such as is involved in any chemical reaction. But surely this modern point of view with regard to the nature of variations—which has been made possible by the epoch-making discoveries recorded in "Mendelism"[12]—is unequivocally demanded by the theory of enzymes.

If we believe that the organs and functions of living creatures are determined in nature by the number and quality of the catalytic substances contained in the germ-cell, we must perforce hold that these organs and functions will vary in accordance with the changes which take place

[11] Johannsen, *Lowell Lectures*, 1912.

[12] See, for example, R. C. Punnett, *Mendelism*, 1911.

in this assemblage of enzymes. But since the enzymes are definite chemical compounds *all significant alterations* of this sort *must be qualitative and discontinuous.* It is not strange, then, that organic species should be readily comparable in their properties to the discrete bodies known to chemical science. The doctrine of De Vries that all effective biological variation consists in the addition or subtraction of Mendelian "unit characters" is quite unescapable in the theory of enzymes, for in that theory the "unit characters" correspond, as we shall see, to the individual enzymes of the germ-plasm. "Bio-types" are at bottom *zymo-types.*

The limits of this article are such as to render impossible a detailed description of the probable series of changes by which the mechanism of chemical variation which we have discussed above has been able, with the assistance of natural selection, to "evolve" living creatures as we now know them from the basis provided in "primitive protoplasm." The general principles which are involved are, however, clear. Each new enzyme which is generated within the life substance adds a new character. "Primitive protoplasm" possessed but one essentially vital property: the power of self-reproduction or growth. The other fundamental characteristics of developed protoplasm, irritability, contractility, and the destructive metabolism upon which they are based must be regarded as results of a long process of evolution. "Simple protoplasm," as we have insisted before, must have a complex chemical history. *There is practically no effect which is produced within living cells which cannot be referred to the presence of a suitable enzymic substance.* Divergence of characters among the many lines of descent leading from "primitive protoplasm" are, of course, to be expected, and variations in the type of metabolism which are selected in these di-

verging lines will lead ultimately to the foundation of two biological kingdoms: the animal and the vegetal.

In the beginning all living forms were, of course, of the single-celled or globule type. No difficulty exists in explaining the manner in which the chemical constitution of single cells could determine their cohesion into the large *cell masses* which make up the multicellular plants and animals, and the process by which the differentiated cells and cell-systems of these higher organisms are produced by the continued subdivision of an original germ-cell can also be explained in terms of enzymes. This is a subject to which we shall return in our next section.

THE ENZYME AS THE GROUND OF HEREDITY.

The difficulties which neo-vitalists urge against the mechanistic theory of heredity may perhaps be adequately summarized as follows. In the first place the germ-cell, which must be regarded as of prime importance in any mechanistic view of heredity, is said to be too small to contain a physical machine that shall be capable of determining with accuracy all of the intricacies of structure and function which are exhibited by the higher organisms; in the second place no *definite conception* has been advanced to show how such a hypothetical determining influence can exist. Weismann's theory that the manifold properties of the individual living organism are dependent upon the presence within the germ-cell from which the individual develops, of minute material units corresponding point for point with the separate characters of the organism, provides only the form and not the substance of such an explanation. It is our contention that the theory of enzymes not only removes the objection to the mechanistic account of heredity which arises from the extreme smallness of the germ-cell, but that it also provides us with an idea of *the definite chemical mechanism by which the contents of this*

cell determine the characters of the mature organism, and by which they direct its development. The conception of autocatalysis, also, clears up the third fundamental difficulty of the physico-chemical theory: that of accounting non-vitalistically for the self-reproductive power of the germinal system. With reference to the phenomena of heredity the theory of enzymes is essentially an extension or, better, an interpretation of Weismann's hypothesis.

The theory of enzymes maintains that the causal relationship which exists between the germ-cell and the organism into which it develops, or which exists between a parent and its offspring, finds its necessary material basis in the bodily or catalytic transmission of the original enzymes of the germ to each of the ultimate cells of the mature body. Upon the assumption that the native ferments of any cell constitute its visible "nucleus," a possible description of the manner in which cell characters are thus determined by the germ-plasm is suggested by the microscopically observed facts of "karyokinesis," or the maneuvers of the nuclear substance during cell-division. This process has been incorporated by Weismann in his theory, and since it enters into the theory of enzymes in an entirely analogous manner we need not give an account of it in this article.[13] But if the cell characters are actually chemically determined by catalytic substances which are present in the nucleus, it is clear that the highly elaborate mechanism of karyokinesis, which, in each case of cell-division, divides the nucleus into two parts and bestows one moiety upon each new cell, is nicely fitted to a transmission of cell characters from ovum to body tissue.

But when with this genetic idea clearly in mind we are confronted by the enormous complexity of many multicellular organisms, we realize that if the mechanistic conception is to hold, the initial cell must be exceedingly com-

[13] A. Weismann, *The Germ Plasm,* 1893, Chap. I, pp. 37-86.

plex; it can be no simple drop of homogeneous protoplasm, but must enfold within its tiny body a surpassingly intricate mosaic of separate characters. Moreover, throughout the successive stages of development by the segmentation of the primal ovum there must go on a sorting or sifting process in which certain characters are separated out and laid down, seeded, as it were, in definite portions of the body. We come to think of the germinal elements as submicrocosms, representing or symbolizing the organic body in detail. The ovum and the sperm must be regarded as architectural structures built up by the conjunction of a vast number of unit enzymes, which during development are taken down in successive steps and segregated in different organs and tissues where they exercise, by virtue of their catalytic power, that specific control or regulation which has so mystified modern physiologists, and has encouraged so many vitalistic diatheses of mind.

The observed facts of the relationship of heredity are such as to confirm this conception of the mosaic and zymotic nature of the reproductive elements. The phenomena first described by Mendel in 1865 present a case in point. It is noted that an organic characteristic like tallness in plant body, or the redness of blossoms, or an hereditary deformity, acts in experiments in the crossing of different varieties of a species as if it were a definite and discrete quality, which in any particular hybrid is forced either to appear or to be entirely absent, which cannot, in other words, be mixed, blended or compounded with a different character. It is this set of facts which leads to the conception of "bio-types," and which is so consonant with the demands of the De Vriesian doctrine of mutations, and also—as we have seen —with the theory of enzymes. The idea that the "unit characters" of Mendelism are, in their substantial aspect, specific enzymes embodied in the germ-cell and manifesting themselves in the developed organism, is almost inevitably

suggested by the facts; many Mendelists definitely compare the "unit character" to a ferment.

The characteristic activities of any special *tissue cell* may be conceived as governed by the presence in its cytoplasm or nucleus of specific enzymes which facilitate certain types of chemical change. These are the "biophores," or life-bearers, of Weismann's theory. But it is clear that when the development of the organism is yet incomplete there will exist many more or less undifferentiated tissues, and in the cells of these we should expect to find a variegated store of biophores, presaging the further differentiation of the living stuff which is there present. Since rudimentary tissues of this sort are divisible into more or less discrete systems, as nervous, skeletal, alimentary, etc., we might expect to find a corresponding systematization among the controlling enzymes. Such groupings of biophores are called by Weismann "determinants." In a still more undeveloped state the enzymic contents of the organic cells will be even more complex, and will be divided into more comprehensive systems, which Weismann denominates "ids" and "idants." Each "id," according to the author of the theory, contains the potentialities of a complete organism; the "determinants" are units corresponding with the number of independently variable organic parts, and the "biophores," in our interpretation, are the ultimately life-regulating enzymes. It will readily be seen that the Weismannian mechanism of heredity is in perfect harmony with the elementary laws of Mendelism, and it is also consonant with the facts which have been established by the direct microscopic observation of the cell.

Upon our assumption that the "determinants," "ids," and "biophores" of Weismann, the "unit characters" of Mendelism, and the specific attributes of living matter in general are actually representations of the presence and

distribution of definite enzymes or organic catalysts in the body and in the germ, what shall be the line of argument taken in an attempt to elucidate the processes through which the organic characters of living matter are developed under the influence of the original germinal ferments? Clearly the matter will not be a simple one, but nevertheless it seems advisable to mention some of the conceptions which the physiologist of development must use if he is to attempt a *zymology of heredity*. His ruling idea, of course, must be that same conception of a specialized catalyst which was outlined in the second section of this paper.

Zymology has already gone far enough for us to assert the empirically demonstrable existence of hundreds of bodies of this type. But the interrelations of enzymes with each other and with the substances whose reactions they affect are very diverse. We must recognize the possibility of—so to speak—an indefinite number of degrees of *zymicity*, from enzymes which take absolutely no part in reactions under their influence to others which are gradually or rapidly consumed by the chemical forces which they encounter. Besides ordinary catalysis we may have to deal with "negative catalysis" for certain bodies interfere with the catalytic effects of enzymes or of inorganic catalyzers. The presence of such "anti-enzymes" may be employed by the hereditary zymologist in accounting for the inactivity of enzymes which are present in tissues but which fail to produce in them their characteristic effects. The "kinases," or "co-enzymes," must also be taken into consideration. These are empirically demonstrable bodies which are capable of catalyzing catalysts, or at least of reacting with certain other bodies, "zymogens," to form enzymes. It is clear that the enzymes concerned in the development must all be capable of self-reproduction, or of autocatalysis, and in the mazes of this process may lie the ex-

planation of many strange phenomena. The structure of any given cell—based in the last analysis upon prior enzymic activity—its component membranes and their osmotic permeabilities, must also inevitably enter into questions concerning the points of equilibrium of catalyzed reactions, etc.

Can the theory of enzymes cope with the difficulties of the problem of heredity? It is our belief that it will be able to do so. The enzyme meets perfectly the requirements which must be satisfied by any physical entity purporting to be able to form the basis of the elementary hereditary relationship. Its most characteristic effect upon chemical mixtures such as that which is presented in the almost watery constitution of the living organism is that of regulation, and it is recognized by every one that the hereditary relationship is *par excellence* one in which regulation occurs. Upon purely chemical grounds it is found legitimate to endow the enzyme with that supposedly peculiar property of life: self-reproduction or regeneration. The theory of enzymes thus satisfactorily disposes of one of the fundamental vitalistic objections to the Weismannian hypothesis as it was originally formulated, and permits us to regard one of the most characteristic functions of living matter as a purely chemical phenomenon. But the enzyme also beautifully fulfills the geometrical requirements which are made by Weismann's typical mechanistic hypothesis upon the controlling entities of the germ-plasm.

As we saw in the second section, catalytic effects are remarkable for the small quantity of catalytic substance which is required to produce them; one part of catalyst in many millions of reacting substance will often suffice to bring about a very great acceleration of the reaction velocity. It can be shown by a simple calculation that the human germ-cell is sufficiently large to contain a million molecules of specific enzymic material for each of the bil-

lion or more cells in the human organism. These million molecules of course constitute a very minute portion of matter, but since they are both catalytic and autocatalytic they may be relied upon to produce far-reaching changes in the other chemical substances which come into contact with them. The theory of enzymes complements Weismann's hypothesis in another way by showing how it is possible that the germinal determinants should actually be effective in the development of the organism. It is one thing to show that the germ-plasm may contain an element for each specific part of the body which springs from it, and quite another to explain how such a material particle can determine by purely physical laws the peculiar development of that body.

THE ENZYME AS THE BUILDER OF ORGANISMS.

The most powerful of the unfavorable criticisms which have been brought to bear upon the physical theory of life during modern times have been founded upon the results of the new science of "experimental morphogenesis," or the empirical study of individual development. In an article such as this it is impossible to present and analyze in detail the results of this new and fascinating line of investigation, but as any one knows who is acquainted with the writings of Hans Driesch,[14] the most philosophical student of the new science, the physico-chemical theory of development cannot rigidly maintain the logically simple form given to it by Weismann, if it is to harmonize with all of the facts. The manner in which the germinal determinants are distributed in the process of cell multiplication cannot be thought of as a perfectly straightforward differentiation, in which every cell-division signifies the production of a radical and permanent disparity between the enzymic constitution of the two resulting units of structure. The

[14] H. Driesch, *The Science and Philosophy of the Organism*, 1908, Vol. I.

differentiation of cell constitution must needs be conceived as gradual, relative, and perhaps never quite complete; in many cases differentiation may be an expression of processes of chemical suppression or interference, rather than of the actual loss or exhaustion of the original determinants of the germ-cell.

At first sight it may seem that a failure on the part of the mechanist to present a logically simple hypothesis of development which shall explain all of the facts places him in a rather embarrassing situation; but this is not actually the case. Indeed, quite the reverse is true. If the mechanism of development were describable in simple formulae, this fact would add cogency to the vitalistic contention that some intelligent principle had been at work in the establishment of this mechanism. The mechanist is prepared to discover in embryological processes the effects of crudely diverse means of adaptation, of both rudimentary and vestigial developmental tendencies, and of a type of correlation between internal and external forces which is—so to speak—ragged-edged and diffuse. If we adopt the point of view thus suggested we shall find that many of the objections which have been raised by vitalism against the physico-chemical theory of life, on the basis of experimental embryology, will lose much of their cogency. All of these objections are founded upon the hidden assumption that a mechanistic account of the causes of individual development must be logically simple, that if the mechanist employs catalysis in his explanations he must make no concomitant use of osmosis, that if there are material hereditary determinants in the nucleus of the cell there cannot at the same time be any such in the cytoplasm, that if these determinants have a causal efficiency in the process of differentiation and growth general physical and chemical influences are thereby ruled out.

We have offered the above generalizations in lieu of

a detailed discussion of the vitalistic arguments of Driesch and other students of embryological development, not only because the limits of this article forbid such a discussion but also because the facts of "regeneration" and recovery from injury on the part of embryonic tissues have no special bearing upon the enzymic theory of heredity and development. The objections based upon these facts must be rebutted if the enzyme theory is to hold, but they are applicable to any mechanistic hypothesis whatsoever. Weismann's doctrine of germinal determinants in its simplest form assumes that there is a progressive simplification of the determining material of the body cells as individual development proceeds, and if this is what actually occurs it is of course impossible that one of these simplified cells should be able itself to generate any organic system different from or more complex than that of which it forms a homogeneous part. Thus a liver cell might be able to generate further liver cells, but it could not provide the starting point for the development of a new organism, or for the replacement of a missing limb. Certain exceptions to this apparent corollary of the Weismannian theory have been discovered in embryological research, and have been avidly appropriated by vitalism for use in its contest with the physico-chemical theory of life.

The general explanation which the mechanist will probably be forced to make of these exceptions lies in the supposition that all of the cells making up a given portion of an organism are not equally differentiated as regards their nuclear or enzymic substance, but that at every stage in the process of cell-simplification which is supposed to accompany development, certain cells are left behind and that these—since they possess an adequate complement of enzymic material—can, upon receiving the appropriate stimulus, regenerate any required "lost part." Residual or latent cells of this sort all belong to the same general type

as the germ-plasm itself, which is known to coexist with the differentiated somatic cells of the organism.

It is essential that we should recognize the fact that there are a great many processes in the physiology of development, and of mature life, which are explicable upon a physical basis wholly apart from the directing and "self-determining" activities of the cell. Bionomics—the study of organic symmetry and related subjects—shows that differentiations of structure in animals and plants occur in fixed and parallel orders; the underlying facts of symmetry in the body reduce the strain upon the germ-plasm, the bilateral, radial and metameric repetitions of organic characters would not require new sets of determinants but simply reproduction of the old ones in accordance with some slightly modified symmetrical karyokinetic process. The modes of repetition, in fact, are found in many cases to depend upon purely physical and environmental conditions; the forces of growth are limited by other forces outside themselves, the laws of geometry and physics.

All of these considerations tend towards the judgment that the germ-plasm need by no means be as complex as the organism into which it develops. There are certain things which would happen to any mass of protoplasm exhibiting growth; the determinants of the cell have to react with other natural forces in the production of the organism, with its mature anatomy and physiology. But while there can be no doubt that as development goes on the events which occur in the body are determined more and more by the physical and chemical interactions of different organs and tissues, this need not be taken to mean that these events would ever have occurred if it were not for the special enzymic constitution of the germ-cell.

The differentiation of organic form in the course of individual development, and in the evolution of species, must ultimately be determined by *a control of the planes*

of cleavage of the individual cells. This control may very well depend, in the last analysis, upon the molecular form of the germ-plasm. Identical chemical units may be combined in a great variety of ways, and the ordered decomposition of specific molecular groups may be relied upon to determine the relative directions of cleavage of the dividing cells and thus to regulate organic form even without chemical differentiation. The theory of enzymes does not place the processes of heredity and development in exclusively chemical categories; it does not dispense with the mosaic or structural factor in the germ-plasm. Indeed, when we clearly understand the meaning of chemical terms, we see that it would be impossible to eliminate this factor, even though we desired to do so. It is therefore legitimate to suppose that the determining enzymes of the germ-cell are arranged in a practically constant order, the unfolding of which regulates the form as well as the physical and chemical properties of the body.

The manner in which an enzyme may control structural changes is almost too obvious to require comment. We have noted that substances exhibiting almost any conceivable property or set of properties can be built up from the primary materials of protoplasm; the element carbon is the most versatile member of the chemical world. But the reactions which generate such specific substances from the raw material of the cell-plasm may be controlled by special enzymes, and in the event of such regulation the reactions in question will occur only in regions already containing the requisite enzymes. But the position of specified enzymes at any moment in development will be determined, among other things, by their position and chemical relationships within the original germ-cell. The most primitive and the most important case of the enzymic control of structure is found in the reproduction of the germinal mosaic itself. Since each catalytic component of the mosaic

is entrusted with its own regeneration and since this regeneration can take place only in the proximity of the catalysts themselves the outcome of the autocatalytic changes must clearly be the practically perfect reduplication of the original system, both in respect to configuration and to chemical nature.

THE ENZYME AS THE GUIDE OF FUNCTION.

Modern physiology started out upon the assumption that all vital processes could be reduced to chemical and physical interactions, ultimately to a purely chemical causation, since all of the mechanical, thermal, and electrical changes which take place in the body are but the secondary expression of chemical energies, liberated in molecular reactions. The task of stating the exact chemistry of organic functions is one towards the completion of which a great deal has been accomplished; by untiring experimentation and argument we have acquired a fairly clear understanding of many of the activities of the animal and plant body. Such processes, for example, as digestion, assimilation, respiration, etc., may now be partially restated in chemical terms, and we can see how the more grossly physical changes occurring in the organism depend upon these finer molecular interactions.

But along with this scientific advance there has come ever more cogent evidence of the presence within the living body of constantly effective forces of regulation.[15] We may understand perfectly the purpose and chemical relationship of the bile—for instance—but have still to ask ourselves why it is that bile is secreted so constantly by the liver and not by the stomach, which is, and always has been, nourished by an identical chemical mixture, the blood. Moreover, how upon a purely chemical basis are we to explain the processes of growth and of repair? No doubt

[15] Cf. W. Mac Dougall, *Body and Mind*, 1912.

growth and repair involve chemical syntheses, but how are we to account for the fact that these changes are almost invariably of the right kind, and occur in the right place? It is the seemingly *teleological regulation* of chemical reactions which baffles the explanatory efforts of modern naturalistic physiology.

In many minor cases physiologists have discovered that specific bodily functions are under the control of special enzymes. This is the case with gastric and intestinal digestion, and it is seemingly true also of respiratory processes. They have even been able to go one step further and to show that the original production of the enzymes themselves is conditioned by the presence of still further enzymes of a higher order, the so-called "kinases." Here we have clearly suggested the idea that the regulation of the fundamental chemical reactions of the organism may ultimately be traced back to the original enzymic material deposited or left in the body cells during the course of embryological development, so that the control would causally revert to the constitution of the germ. If this suggestion were accepted it would not be hard to understand why this control should appear teleological, since we must perforce conclude that types of control lacking in utility would be eradicated in the struggle for existence, once they were supposed to depend upon the structure of the germ-plasm.

Is it not conceivable that most of the difficulties which are encountered by the chemical physiologist—difficulties, mainly, of accounting for certain more or less fixed types of regulation—may be cleared away by the theory of enzymes? This, indeed, is our thesis, for the enzyme is preeminently a regulator, and we have seen that in all probability it lies at the bottom of the relations of heredity and development with the processes of which the factors in mature physiology are immediately continuous.

Under appropriate circumstances enzymes may facili-

tate any conceivable variety of chemical change, whether it be one of synthesis or of decomposition. As we said at the outset enzymes lubricate chemical reactions so that they are able to reach their natural points of equilibrium with more than normal rapidity, and it makes no difference whether the attainment of this equilibrium point involves constructive or destructive operations. Accordingly enzymes may be the controlling factors in both phases of metabolism, the upward and the downward.

Enzymes fix the *organic position* of definite chemical changes, and in doing this determine the so-called specific energy of the organ or tissue which is concerned. The principle of specific energy is one of the broadest known to physiology, and stands for the fact that when particular masses of protoplasm are subjected to a stimulus they always respond in a characteristic and uniform way, regardless of the nature of the stimulus. If we inquire into the nature of this specific energy we find that its manifestations are most easily explicable upon the assumption that it is essentially enzymic in character, for enzymes are always specific and they are universally present in protoplasm.

There exists a good deal of physiological evidence to show that the characteristic reactions of cells depend upon the presence and nature of their *nuclei.* And, as we have already noticed, the cell-nucleus is supposed in the theory of Weismann to contain the hereditary determinants, and hence, in our hypothesis, the enzymes. Consequently we must regard the nucleus as the real connecting link between mature cell activity and the constitution of the germ, as well as between both of these and the evolutionary history of the species. But, as we have already intimated, this conception of the nucleus as the bearer of vital characters is not inconsistent with the concomitant presence of enzymic matter in the cytoplasm, or extra-nuclear portion of the cell.

But does not this physiological application of the theory of enzymes provide us with the skeleton of an explanation of that "teleological ordering" of vital phenomena which certain modern thinkers have found themselves at a loss to explain upon a physico-chemical basis? If it is true that all of the processes occurring within the living body are determined with a high degree of precision by the chemical zymotic constitution of the cell-nuclei, and if—as in our discussion of heredity and of individual development we have found reason to believe—the substance of the cell-nucleus is derived from and is chemically the same as certain portions of the original germ-plasm, how would it be possible for vital phenomena to have other than a "teleological ordering"? To speak of the geulation of organic functions as "teleological" is formally equivalent to the assertion that the processes in question are uniformly such as to conduce to the integrity and survival of the organism. But if all existing germ-plasms have been subjected, as we believe, to a rigid testing under "natural selection," the functions which they determine must perforce be of such a sort as to assist the species and the individual in their "struggle for existence."

One factor which tends to confuse the physiologist's judgment upon such matters as this is the great complexity of the bodily processes. This intricacy is especially perplexing whenever a function seems—so to speak—to possess *options,* when there are a number of ways in which a particular desirable organic change can be brought about. But this capacity which is often exhibited by organisms of "trying again" and in a different manner to consummate a certain effect cannot be brought forward as an argument against the hypothesis of chemical control which is offered in the theory of enzymes, for, suggestive as these "trial and error" methods are of conscious purpose, the number of "options" is limited, and each of these options can always

be referred to components of a complex evolutionary history of the species, components of experience or selection in which the typical organism has succeeded under varying conditions of reaction, in obtaining the same result by different means. Where actions are actually random we may of course refer them to the influence of the molecular chaos which may be effective in the individual as in the species whenever, as in the process of learning, new and accidental variations in behavior prove useful.

CONCLUSION.

As we stated at the beginning, this article purports to be nothing more than a vague outline of the theory of enzymes as it is concerned with the question of the origin and regulation of organic activity. From the nature of the subject-matter which it involves such a theory must of necessity be elaborate and detailed. We have been able to indicate here merely its general principles and points of application to biological problems. It must be left to further supplementary expositions, and to controversies, to bring out the details of the theory; and this is a field of inquiry in which details are of great importance.

It has been our purpose to show that the conception of the enzyme is not only of use in the explanation of such every-day processes as digestion and fermentation but that its explanatory power reaches down into the roots of life. *Life, according to our conception, is something which has been built up about the enzyme*; it is a corollary of enzyme activity. And we have attempted to show how this might be true by exhibiting the enzyme, first, as the creator of life, second, as the basis of its development and differentiation, and, finally, as the guide of its now observable functions. We have seen that by the use of the enzyme concept we can throw light upon practically all of the fundamental problems of biology, those of the origin of

living matter, of the source of variations, of the ground of heredity, and of the mechanism of vital regulation. These are the credentials of the enzyme theory of life; whether or not they will prove adequate to its acceptance the future alone can decide.

The theory of enzymes is advanced in this article in rebuttal of vitalism. Nearly all of the objections which are raised by neo-vitalists against the physico-chemical interpretation of life can be reduced to questions of the basis of vital regulation, and we have throughout striven to demonstrate that the concept of the enzyme provides us with a strictly physico-chemical mechanism of regulation, and on which is at the same time consistent with all of the fundamental peculiarities of the vital regulative principle, its self-reproductive power, its liability to variation, its physical minuteness, etc.

No doubt there are certain important points in vitalistic arguments which the enzyme theory does not directly affect. For example, we have not attempted to provide an explanation for the alleged facts of "orthogenesis," or of variation in a continuous direction. But special considerations will no doubt throw light upon questions of this sort.

Another problem which we have not touched upon is that of the origin and nature of consciousness. This is really a philosophical and not a biological issue, and its discussion involves a point of view wholly different from that of the present article. Even among vitalists the most intelligent thinkers do not confuse the problems of psychology and those of physical science.

Prof. E. B. Wilson, who is one of the foremost modern cytologists, has formulated the fundamental problems of heredity in the following four questions:[16] What is the physical basis of heredity? How is it transmitted from

[16] E. B. Wilson, "The Problem of Development," *Science*, 1905, N. S., XXI, pp. 281-294.

cell to cell? How does it transmit hereditary characters? How may it be so modified as to give rise to new heritable characters? It is our contention that in a general way the theory of enzymes satisfactorily answers all of these queries. It unmistakably provides a physico-chemical basis for fixed and definite inheritance, and for the "spontaneous" production of just those De Vriesian "mutations" which seem to be required by the modern study of the evolutionary process. The crucial problem of "Darwinism to-day" is that of the source of variations. Certainly the theory of enzymes makes obvious a solution of this problem which is not only in harmony with Weismann's hypothesis with regard to the hereditary mechanism but which, by its utilization of a well-known physical conception—that of the "molecular chaos"—decidedly strengthens the general bond between the organic and the inorganic.

In his analysis of the factors which enter into development Hans Driesch has expressed the actual fate of any specified cell of the embryo as a mathematical function of three variables: $p.v.(\mathrm{X}) = f(s, l, \mathrm{E})$.[17] This means that the "prospective value," *p. v.*, of the cell X is determined by the absolute size, *s*, of the mass of which it is a part, by its position, *l*, in that mass, and by a third factor, E. In the theory of Driesch, E represents the vital principle, which he calls "entelechy," and it is his main thesis that the factor E cannot correspond with any conceivable physical or chemical entity. Driesch asserts in his "second proof of the autonomy of life"[18] that "entelechy" is "at the bottom of inheritance." The "proof" which he offers is one which is readily rebutted on the basis of the theory of enzymes, but the fact which it is important for us to notice is that Driesch's "entelechy"—which is the most clearly formulated vitalistic concept that has appeared in

[17] H. Driesch, *The Science and Philosophy of the Organism*, Vol. I, p. 132.

[18] H. Driesch, *The Science and Philosophy of the Organism*, Vol. I, p. 224 ff.

the history of human thought—has charge of all of the specifically regulative functions of the organism. It is the ground of every complex purposeful adaptation; in a word, it accomplishes just those tasks which we have assigned to the enzymes of the germ-plasm. And, conversely, if due allowance be made for the great structural intricacy of the reproductive mechanism as necessitated by its evolutionary history, we shall find that there is nothing which can be performed by "entelechy" which cannot equally well be mediated by the enzyme. Is it not, then, legitimate to parody the symbolism of Driesch, and to write: E = *enzyme*? That this is an equation the possibility of which the great vitalist himself will find it difficult to deny upon reasonable grounds is suggested by the results of his painstaking and altogether too exact analysis of the conditions under which "entelechy" is able to interfere with the course of physical events. In the Gifford lectures for 1908—on "The Philosophy of the Organism"—Driesch arrives at the conclusion that the point of contact between the vital principle and material changes may be found in the "activation" or release of enzymes within the protoplasm.[19] But it is a well-known fact that in many cases such an "activation" is conditioned by the presence of—so to speak—enzymes of the second order: the "kinases," which we have already mentioned as probable factors in the developmental process. It would appear, then, that the arguments of Driesch himself lead their author unconsciously to the door which, when opened, will reveal the enzyme—and not the mystical "entelechy"—as the pilot of life's journey.

LEONARD THOMPSON TROLAND.

MALDEN, MASS.

[19] H. Driesch, *Op. cit.*, Vol. II, p. 187.

CRITICISMS AND DISCUSSIONS.

THE ECONOMY OF THOUGHT.

I.

From the earliest times until the seventeenth century mathematicians were chiefly occupied with particular questions—the properties of particular numbers and the geometrical properties of particular figures, together with simple mechanical questions concerning centers of gravity, the lever and so on. The only exception to this was afforded by algebra, in which symbols (like our present x and y) took the place of numbers, so that, what is a great advance in economy of thought and other labor, a part of calculation could be done with symbols instead of numbers, so that the *one* result stated a proposition valid for a whole class (often an infinity) of different numbers. Such a result is that which we now write:

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3,$$

which remains valid when we substitute any particular numbers for a and b, and labor in calculation is often saved by the formula even in this very simple case.

This reflection, which is quite an evident one, came in an article of mine on "The Relevance of Mathematics" published in 1909.[1] In a note, I referred to some criticisms on Mach's idea of the economy of thought in science, which had been made by Mr. N. R. Campbell.[2] Mr. Campbell's objections seemed and still seem to me to rest on a misunderstanding of what Mach really meant. This is part of the note:

"Perhaps the phrase 'economy of thought' is not well chosen, and may lead to such misunderstandings; the principle is meant to direct attention to a rule of scientific method which can be readily admitted, and certainly the goal of science will not 'have been attained when its students, guided by this principle, have ceased to think.'

[1] *Nature*, Vol. LXXX, 1909, pp. 382-384.

[2] *The New Quarterly*, Vol. I, 1908, p. 498.

This rule may be thus described. As science advances, besides actually overcoming an obstacle, it consciously or unconsciously leaves marks of guidance for those who come after; so that those obstacles which required great genius to overcome in the first instance afterwards became quite easily so. This is necessary in order that our energies may not be spent by the time that we reach a new obstacle not hitherto surmounted; and 'economy of thought' means the sparing of waste of the energy of thought whilst treading the path already trodden by our predecessors, so that we may keep thought for the really important new problems—not that we may cease to think about new problems.

"And thus we have legacies left by great men, such as Lagrange's analytical mechanics and Fourier's theory of the conduction of heat, which are merely inventories of extensive classes of facts, arranged with wonderful compactness.[3] In this description of an infinity, perhaps, of facts by a *few* formulas, there is undoubtedly an esthetic motive and value; but apart from this there is this important economical aspect: that a multitude of particular facts and 'laws,' which we had hitherto to remember, actually or artificially (in a note-book or library), is, in the theory, comprised in a few symbolical formulas, which only require *logical* development to get at the particular cases. From this point of view we get the apparent paradox that 'economy of thought' leads to the replacement of memory by reason. The solution of the paradox is that logical development can be made more mechanical even than memory, and that thus thought is spared, so that we can concentrate it on the unsolved problems which are always coming into our field of vision as we advance.

"The tendency to economy of thought, which is shown in the growth of physics—for example, in the inclusion of the particular Biot's law of the distribution of temperatures in Fourier's theory[4]—may also be seen in the symbolism of pure mathematics."

II.

This criticism of a criticism led to a hitherto unpublished discussion between Mr. Campbell and myself. As I think there are points of interest about this discussion, I proceed to give some account of it.

Mr. Campbell replied to my remarks on his criticisms of the

[3] Cf. Mach, *Die Principien der Wärmelehre*, 2d ed., Leipsic, 1900. p. 115.

[4] Cf. *ibid.*, p. 81.

principle of the economy of thought in a letter of May 28, 1909, addressed to the editor of *Nature*. This letter and the subsequent discussion were too long for the correspondence columns of *Nature*, and through the courtesy of Mr. Campbell I am here enabled to give a reproduction of his letter:

"In his article on 'The Relevance of Mathematics' Mr. Jourdain seeks to refute some criticisms of Professor Mach's principle of 'economy of thought,' which I made in a recent number of the *New Quarterly Review*. Since my reference to Professor Mach was only incidental, perhaps I may be allowed space to elaborate my position a little further in reply to Mr. Jourdain.

"Mr. Jourdain says that Professor Mach does not mean what he says, and in this I agree with him. If I imagined that he really intended to assert so ridiculous a principle, I should not have so very great a respect for his writings. But undoubtedly he has been taken literally by many people, and it is therefore permissible and desirable to criticize the letter as well as the spirit of his statements. Accordingly I must point out again that, if the object of science is the economy of thought, the best science is that which requires no thought: 'The object of science will be attained when its students have ceased to think.' Nobody can consistently maintain the literal interpretation of Professor Mach's principle and hold at the same time that science has the smallest intellectual value.

"According to Mr. Jourdain the principle that Professor Mach intends to assert is that of the economy of memory at the expense of reason. I repeat that this may be what Professor Mach means, but it is certainly not what he says; for reason is as much 'thought' as memory. But, if the principle is put in this form, I agree readily that it describes roughly the motive of a great part of what is ordinarily termed 'science,' for memory is the most obvious example of a form of thought which has no esthetic value for most minds. Laws are, indeed, partly efforts at the economy of memory at the expense of reason, but their value lies at least as much in the expenditure of reason as in the economy of memory. Landolt and Börnstein's tables are far more efficient in saving memory than all the laws that were ever discovered, but nobody (except, perhaps, certain chemists) would consider them the ideal of a science.

"It is in connection with theories that the principle of the 'economy of thought,' taken literally or interpreted by Mr. Jourdain, is so utterly absurd. (I have explained the distinction between a law and a theory in the article to which Mr. Jourdain refers.) It

is perfectly true that theories *might* save memory, but it is perfectly untrue that they *do* save it, or that it is for their economizing properties that they are valued by men of science. For conviction on this point Mr. Jourdain has only to examine our practice. Does a physicist, when he wants to know the effect upon the volume of a given mass of gas of changing the pressure, reflect for a moment upon the kinetic theory of gases? Would an astronomer, accosted suddenly, confess complete ignorance of Kepler's laws and ask for time to examine the consequences of the theory of gravitation? Of course not. No man in his senses ever reconciled himself to forgetting a law because he knew of a theory by which it was explained, for the simple reason that the mental effort of deducing the law from the theory is even less pleasurable than that of remembering the law. A theory economizes nothing. It is a pure addition to our thought, and it is valuable in proportion to the value of that which it adds. If science were merely an elaborate method of pampering the mental indolence of mankind, it would be better left to those who care for nothing but a base utilitarianism. It is because theories provide us with ideas the contemplation of which is of the very highest esthetic value, that science is a worthy employment for the noblest intellects.

"The failure to distinguish clearly between the relatively unimportant law and the essential theory, which marks the work of most of those who write of the 'philosophy of science,' is due largely, I think, to the fact that so many of these authors are primarily mathematicians. They naturally seek for some motive in science which presents an analogy to that which inspires their own splendid study. The rationale of pure mathematics is, if I understand rightly the treatise of Mr. Bertrand Russell, absolutely unique among all forms of thought, but there is in its methods some element which shows a rough, a very rough, analogy to the formation of scientific laws. But no opinion could be more erroneous than the prevalent view that mathematics and science are closely connected species of a single genus of thought. The essence of a science is its theories, and for a theory the analogy is to be found not in mathematics but in metaphysics, and still more in art. The debt of physicists to mathematicians is incalculable, but when their long and fruitful intimacy leads to the development of a '*Naturphilosophie*' which respects nothing but 'facts,' and to the glorification of that magnificent lie, *Hypotheses non fingo,* on that part of him who alone in his stupendous genius could embrace the highest developments of instincts

so diverse as the mathematical and the physical, it is time to insist that it is a mere friendship and not a deep tie of blood and lineage."

III.

This letter, which was forwarded to me at the time (June 3, 1909) by the editor of *Nature,* suggested to me some reflections of which the following is a copy:

"The chief difference between Mr. Campbell and myself seems to be concerning the ends of science. With Mach, I believe that the object of natural science is to complete in thought what we observe only slowly and partially; this object seems to me, at bottom, a practical one. It is true that science gives us noble ideas for our contemplation; this fact comes home to one in spite of its constant repetition in works on popular science. But it is, I think, a mistake to lay exclusive stress, as Mr. Campbell seems to do, on this purely intellectual function of science, and to depreciate its more obviously utilitarian aspects. Even if astronomy had no other purpose than to produce the *Nautical Almanac* it would be hard on it to call its purpose "base." If Mr. Campbell is right, then: (1) the essence of science is much more like art than I had supposed; (2) not only have many readers misunderstood Mr. Russell's work, but also Mr. Russell himself, for he maintains that the rationale[5] of pure mathematics is not unique among forms of thought, but *is* logic; and lastly (3) science is merely friendly to logic and not otherwise related to it. So Mr. Campbell's rightness would mean that the hopes of many of us must be given up.

"Until I read Mr. Campbell's letter, I maintained that the real meaning of Mach's principle of the economy of thought in science was that of the replacement of memory by reason. In fact, the obvious saving of labor occasioned by a formula valid for an infinity of cases, as compared with a set of tables which, often inaccurately and always incompletely,[6] try to fulfil the same purpose, appeared to me so supremely important that I overlooked the importance of a literal economy of thought in science, and Mr. Campbell, by attack-

[5] [Here I take this word to mean the *essence* and not the *methods* of mathematics. The methods used to discover logical propositions need not, of course, be logical.]

[6] "By this, I mean, of course, that no table of the values of a function can give the infinity of particular values of it that we can obtain from a formula. If this is said to be immaterial for practical purposes, there is a vague hypothesis made in that statement about the nature of the function in question; and it is mathematics alone which can state exactly what this hypothesis is."

ing what I did not say, but ought to have said, has rendered me a great service.

"When a man pleads for the economy of thought in physics, there is no more implication that his ideal is a cessation of the need for students to think at all than there is a like implication in his pleading for a symbolic logic. We know how some old-fashioned logicians used to regard symbolic logic: their ignorance of it and its objects merely increased their contempt for it. And by way of reply, I need only refer here to Mr. W. E. Johnson's[7] just emphasis on the fact that 'a symbolic calculus is an instrument for economizing the exertion of intelligence,' which is necessary because the 'intellectual intuition which perceives the truth of laws in their simple—but absolutely universal—form is incompetent to perceive the same truths in more complicated forms.' By a purely mechanical process we do what unaided intelligence cannot do; we do not attempt the impossible,—the total banishment of intelligence from a science concerned with inference.

"But, though we do not wish to banish thought, we do act in such a way as to spare ourselves unnecessary use of it. I am guilty of overlooking this fact, owing to a mathematical bias in favor of a formula over tables. Of course, when one comes to think of it, to abstain from the use of a table of logarithms, and to work out one's logarithm from first principles, would be eccentric. What is most important in the advance from a tabulated function to the law of the function seems to me to be that, by establishing a logical connection between its descriptions of various phenomena it reduces the number of our scientific principles. Before universal gravitation was formulated, we had at least three laws (those of Kepler) of planetary motion. Kepler's laws are still, doubtless, remembered by astronomers—they are not by all mathematicians—, just as tables are used, to economize mental effort that does not add to our knowledge. And Mr. Campbell admits this. We remember Kepler's laws, he says, because 'the mental effort of deducing the law from the theory[8] is even less pleasurable than that of remembering the law.' And yet, to read the first part of Mr. Campbell's letter, one would think that he objected to this admission of his.

"To sum up, Mach's principle, even when taken literally, is not 'ridiculous.' Men of natural science use it to an extent mathematical

[7] "*Mind*, N. S., I, (1892), pp. 3, 5; cf. Mr. A. N. Whitehead's *Treatise on Universal Algebra*, Cambridge, 1898, p. 4.

[8] "What Mr. Campbell here calls the 'theory,' I call the 'formula' (of gravitation)."

people hardly realize—even Kepler's laws are used to save trouble. Secondly, science proper is not concerned with its 'intellectual value.' That it has such a value all admit, but even if it had not, the fact would be irrelevant to science; it would merely fail wholly to displace classics where knowledge is not reckoned by its cash value in ordinary affairs of life. Thirdly, even when I admit that what Mr. Campbell calls a 'theory' has a significance which is not only economical but also logical, I still find myself in disagreement with Mr. Campbell, since he insists that there is no relationship between physics and mathematics (and consequently logic). Fourthly, from our wishing to economize thought as much as possible, it does not follow that our ideal is to abolish it."

IV.

To this discussion I will append a few remarks.

The question is largely one of terminology. Following Mach, I call a "theory" a collection of propositions which describe a domain of experience closely and concisely, and keep the name "hypothesis" for a proposition from which some or (preferably, of course) all of the known facts can be deduced, but which cannot be logically deduced from propositions describing the facts alone. It has occasionally happened that facts hitherto unknown can be deduced from the hypothesis, and certain persons have concluded too readily that such a deduction confirms the hypothesis. However, the hypothesis would only be confirmed if it could be proved that *all* the facts—known and unknown—are in the domain of experience which the hypothesis is supposed to cover. A hypothesis may be true or false; a theory, being a description of the facts alone, is true if, indeed, it does represent the facts.

Mr. Campbell seems to use the word "theory" in the sense in which I have used the word "hypothesis." It may be that "theory" is a more appropriate term for what I have called "hypothesis"; the verbal point need not be argued. And I propose to call Mr. Campbell's "theory" by the name "theory (C)." What is called "the kinetic theory of gases" is a theory (C), and consequently is not what I called a theory. I thought that Mr. Campbell might object to what he called a "theory" being called a "hypothesis," but I am not sure; at least he says that a physicist lies if he says *Hypotheses non fingo*. Further Mr. Campbell used one word "theory" for what I would call the kinetic "hypothesis" of gases and the "law" or "formula" of gravitation.

Mr. Campbell considers that it would be mad to undergo the mental effort of deducing a law from what he calls a "theory," when remembering the law costs less effort; and yet he seems to consider any economy of thought a theory might have as of very small account as compared with the esthetic value of the theory. So far as I can see, it might be more beautiful always to forget laws and deduce them from a theory; then Mr. Campbell would have to admit that the noblest intellects might belong to mad people.

One of the principal functions of science is the reducing of the processes of thought which have already, perhaps with great labor, been gone through by the pioneers of thought, to a mechanism which can be worked by almost anybody without much new thought being required. The point of this is that the energies of those who succeed the pioneers and the systematizers, and the pioneers' work may be spared for the attacking of new problems. Science is not and never will be completed; consequently there will always be new problems, and the state in which all thought is replaced by mere mechanical operations, whose existence would imply that finality in science were reached, will never come to pass. It is this function of science that is the economy of thought; and I emphasized this function in my article more than in my reply. Since my article was written, I have been much encouraged to continue to hold my opinions by reading in Dr. A. N. Whitehead's admirable little book entitled *An Introduction to Mathematics,* the following sentences: "The interesting point to notice is the admirable illustration which this numeral system affords of the enormous importance of a good notation. By relieving the brain of all unnecessary work, a good notation sets it free to concentrate on more advanced problems, and in effect increases the mental power of the race."[9] Then again:[10] ". . . . by the aid of symbolism, we can make transitions in reasoning almost mechanically by the eye, which otherwise would call into play the higher faculties of the brain. It is a profoundly erroneous truism, repeated by all copy-books and by eminent people when they are making speeches, that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle—they are strictly

[9] Home University Library, London and New York, 1911, p. 59.

[10] *Ibid.,* p. 61.

limited in number, they require fresh horses, and must only be made at decisive moments."

V.

In a little book entitled *The Principles of Electricity,* which has been lately written by Mr. Campbell for the inexpensive and useful series called "The People's Books,"[11] he has stated his views on the nature and function of scientific "theories" very clearly.

A scientific "law" is[12] "a collection of simple statements about the occurrence of sensations, but it is not a mere collection; the statements are arranged in a definite order, and connections between them are asserted. Thus the statement of 'amber has been rubbed' represents part of the collection, and the statement that 'amber attracted light bodies' another part; the whole statement does not merely affirm both of these partial statements, but asserts also a connection between them, in that the first sensations represented by the first partial statement occurred before those represented by the other; the kind of connection between the ultimate statements, in which one set of sensations is affirmed to occur before another, is the one which has attracted far the largest share of the attention of writers on the philosophy of science, and the term 'law' is usually confined to propositions in which this connection is very obvious. But it is by no means the only kind of connection which is asserted in scientific statements. Thus the statement that amber is rubbed implies the statement that there is such a thing as amber, and this statement in its turn, as we have seen, means that there is a thing which is yellow, hard, brittle, and found by the sea. This statement may be again resolved into partial statements, such as there is a thing which is hard, that there is a thing which is brittle, and so on; each of which is a collection of statements of the occurrence of sensations. But here the connection between the partial statements affirmed by the complete statement, is not that one series of sensations occurs after the other; a substance is called amber if it is first observed to be hard and then observed to be brittle, or if the order of these observations is reversed. If, however, we proceed yet further and analyze the statement that this is brittle, we find that it means that after it is hit with a hammer it breaks into pieces; the connection of statements concerning the occurrence of sensations by dividing them into two groups, of which one is subsequent to the other, reappears."

[11] London and Edinburgh: T. C. and E. C. Jack.

[12] *Op. cit.,* pp. 12-13.

We may notice that, according to Mr. Campbell, it would appear that there was no place in natural science for hypothetical propositions. No proposition in natural science is analogous to that expressed by: "Trespassers will be prosecuted," unless there are in fact some trespassers. It is, then, rather misleading to state propositions of the form "electricity does such and such a thing" when no proposition that there is such a thing as electricity is yet known.

"It is important," says Mr. Campbell,[13] "to notice that the connection of invariable sequence is by no means the only one possible, and that it is very seldom, if ever, the only one occurring even in those statements which are universally recognized as laws. In these circumstances, the attempt to confine the term 'law' to those propositions in which this connection is especially obvious, appears to me artificial and misleading; and in the sequel that term will be applied indifferently to any proposition asserting any kind of general connection between the occurrence of sensations. We shall term 'laws' not only such propositions as that, when amber is rubbed, it attracts light bodies, but also such statements as that there is such a substance as amber, which is at the same time yellow, brittle, and the rest."

"And now," continues Mr. Campbell,[14] "we may ask how far will this process of establishing laws carry us; we can ultimately attain one law which will sum up *all* the observations which we have made and from which all those observations can be deduced, or shall we reach a stage when several laws are needed to describe all the observations and find that no further progress in the simplification of the description can be made? To answer this question thoroughly would need much more space and much more searching inquiry than is suitable in this place, but I think that there can be no doubt that the complete signification, resulting in the description of all the observations by one single statement, cannot be effected if that statement is to be a law."

If we remember Fourier's theory of the conduction of heat, we shall, I think, dissent from the conclusion that it is always impossible to find a law which will sum up all the observations made in a particular domain of science, and from which all these experiments result. What we call, after Fourier, the "theory" of the conduction of heat is simply a series of logical developments, made with the greatest mathematical skill and originality, of one proposition based on experiment—Newton's law of cooling. However, Mr. Campbell

[13] *Ibid.*, pp. 13-14. [14] *Ibid.*, p. 17.

gives no grounds for his assertion that the connection of all the laws into one statement which shall be itself a law is not possible.

Yet these laws can be connected into one statement which is not a law, but another kind of proposition. And then Mr. Campbell[15] goes on to make a very curious justification for the search for this kind of proposition. The student of pure science "is forced to a new development of science beyond the formulation of laws, because the laws, even when he has got them, do not give him the intellectual satisfaction he seeks; he cannot accept them willingly as the end of his labors. It is quite impossible to say why he is not content with laws, just as it is impossible in the last resort to give any reason for an artistic preference, and fortunately there is no need to make the attempt. For my reader is supposed to be the plain man, and nobody feels more strongly than he the unsatisfying character of laws as an ultimate result of science; I can appeal to his own experience. If this little treatise were brought to a conclusion now, and the reader offered only the laws of electrostatics as the whole pronouncement of science on a great field of investigation, I think he would feel not only that the results were extraordinarily meagre, but that they were of the wrong kind. His natural instinct, unless it had been perverted by the mistaken admonitions of some people who ought to know better, would make him inquire 'why'? 'These laws are all very well,' he would say, 'but I have been expecting to be told why, for instance, charged bodies are able to attract uncharged, or only bodies which are conductors can be charged by induction.' That request voices just the need which leads men of science to their greatest discoveries." It is curious so to appeal to the instinct of the "plain man" when, later on,[16] that very sort of man is rather disparaged: "Those results [of science] are attained by flights of imagination of which the plain man is quite incapable."

"The fresh step, then," says Mr. Campbell,[17] "which we are going to take consists in the substitution for the laws which we have discovered of some other proposition or propositions which shall not be laws. And these new propositions have to fulfil two purposes: first, they have to be such that the laws can be deduced from them, and such that they sum up the laws as the laws sum up the individual observations; second, they have to be such that they give the intellectual satisfaction which cannot be obtained from the laws; for this latter purpose they will have to contain ideas which are more familiar

[15] *Ibid.*, pp 18-19. [16] *Ibid.*, p. 28. [17] *Ibid.*, p. 20.

than those of the laws." Such propositions are what Mr. Campbell[18] calls "theories," and he says that "it should be clear that it [the 'theory'] does represent a new development, and that it is perfectly possible to state the laws of the phenomena without any reference whatsoever to it. The help which it affords is doubtless due to the fact that it reduces the quite unfamiliar actions observed with the charged glass and silk to the quite familiar action of the transference of a substance from one body to another."

Mr. Campbell[19] is careful to point out the risk that there is in using "theories": "A theory suggests a great deal more than it actually asserts." He emphasizes[20] that "science in its highest form is not opposed to art, it is a form of art"; and he is scornful[21] about the study of science for utilitarian reasons. Of course this scorn is right; but it seems rather ungrateful not to remember that science was first developed from utilitarian reasons.

PHILIP E. B. JOURDAIN.

CAMBRIDGE, ENGLAND.

AN ANSWER TO MR. BERTRAND RUSSELL'S ARTICLE ON THE PHILOSOPHY OF BERGSON.[1]

Mr. Russell concludes his criticisms of Bergson's philosophy with the accusation that he confuses subject and object in his theory of perception. "As soon as this identification is rejected," we are told, "his whole system collapses: first his theories of space and time, then his belief in real contingency, then his condemnation of intellect, then his account of the relations of mind and matter, and last of all his whole view that the universe contains no things, but only actions, movements, changes, from nothing to nothing."

The theory that in pure intuition the subject which knows *becomes* its object, is certainly of very fundamental importance for Bergson. In justice, however, it must be remarked that this identification is not the result of a confusion; neither does it apply to thinking by concepts. Therefore Mr. Russell caricatures this theory when he says, "If subject and object are one....my friend Jones, though he believes himself to be in South America and to exist on his own account, is really in my head and exists in virtue of my thinking about him; St. Mark's Campanile, in spite of its great size

[18] *Ibid.*, p. 23.
[19] *Ibid.*, pp. 25-26.
[20] *Ibid.*, p. 28.
[21] *Ibid.*, p .18.

[1] See *The Monist*, July, 1912, Vol. XXII, pp. 321-347.

and the fact that it ceased to exist ten years ago, still exists, and is to be found complete inside me."

Thought about, knowledge by, concepts, involves the distinction between subject and object. It is only in pure intuition that Bergson ever claims that this distinction is transcended. It may fairly be questioned whether such a claim can be justified, but in any case criticisms levelled against Bergson's theory and perception as though it applied to conceptual thought will always be wide of the mark.

There are parts of Bergson's philosophy which are based upon this identification of subject and object, but there is much that is quite independent of it. Setting it aside for the present, therefore, let us consider one by one the important points in Mr. Russell's criticism.

First concerning space.

Mr. Russell's criticisms seem to rest here on a misunderstanding as to what Bergson means by space. The word is perhaps misleading. I believe the truth is that Bergson applies the term "spatial" to any series of distinct units in relations. Mr. Russell himself quotes a passage from *Creative Evolution* in which "spatiality" is described as "nothing but separateness." If this is Bergson's meaning, it follows by definition:

a. that *greater* and *less* imply space;

b. that every plurality of separate units involves space;

c. that all abstract ideas and all logic are spatial.

We may therefore pass over Mr. Russell's objections to these statements.

Again, if "spatiality" means forming a series of distinct units, this explains why Bergson calls thought "spatial."

The intellect operates with ideas and concepts and relations, all of which are distinct units, and it is for this reason that Bergson condemns it. Mr. Russell is therefore wrong in saying that this condemnation "depends upon supposed habit of picturing things side by side in space." The same answer applies to his suggestions that Bergson "mistakes a personal idiosyncracy (i. e., that of visualizing) for a necessity of thought."

In connection with space, Mr. Russell raises the question of continuity in change. Whenever Bergson attacks the mathematical explanation offered for change on the grounds of consistency, Mr. Russell can at once crush him.

Bergson's real objection to this explanation of change, however, is not concerned with its logical consistency. His real charge against

the so-called explanation of change by means of a mathematical continuum is that this explanation leaves out the essential things which is the *process of change.*

The fact is that Bergson starts from the intuition of a kind of change whose essence is indivisible continuity. A so-called continuum made up of distinct units in relations, even though they be infinite in number, is, for him, discontinuous.

He believes that change is a process. We may call this process an indivisible continuity, but this really only comes to the same thing as saying that a continuum composed of units in relations does not truly describe it. Now mathematicians deny that there is any such thing as a process of change. They say that an infinite series of different states in relation to an infinite number of different moments is all we mean by change. Clearly, any argument directed against Bergson which starts from this assumption begs the question.

Bergson claims that change is not made up of any number of unchanging states, and that therefore the explanation of it in terms of a series of states leaves out the essential thing, the process; change consists simply in a process of changing.

So long as Mr. Russell assumes that we do not mean anything more by change than can be explained by a series of points, he and Bergson will always be arguing about different things. Mr. Russell seems to be partly aware of this when he says, that "whether (Bergson's theory of change) is *possible* is a question which demands a discussion of his view of duration." A better way of putting it would be to say that Bergson's theories both of change and of duration depend upon the assumption that change is a process and not a series of points. It is because Mr. Russell never seriously tackles this assumption that his criticism of Bergson does not seem to go to the root of the matter.

Before we pass on to his criticisms of duration, therefore, I propose to try and explain what is meant by saying that change is a process and not a series. If this could be made clear the task of answering Mr. Russell would be easier. Bergson himself, however, must not be held responsible for the following attempts at explanation—they merely stand for what I have understood him to mean and he may well disclaim my interpretations as quite false.

It would have been simpler to divide the problem into two separate questions: (*a*) What is meant by a process of change? (*b*) Why should we suppose that the mathematical description of change is unsatisfactory? Unfortunately this division cannot be

made, because any attempt to define what is meant by a process of change will be circular. Change in process is, in fact, indefinable.

It is claimed that if we try to describe change we have always to regard it as *change completed* and not *in process of changing*. But change completed is something *unchanging*. We can therefore only describe what is unchanging, never change itself. We must leave our first question, then, and pass to the second.

Why should we suppose that the mathematical description of change is unsatisfactory?

We will grant at once that this description is self-consistent. The objection to it therefore must be that it does not describe objective reality as we know it. Change is described by mathematics as a series of states in relations. This description is objected to on the grounds that real change is no such thing.

Let us consider carefully what we know of change. In perception the data are already divided by our senses and our power of attending to one thing at a time. Out of this material the human intelligence has constructed a vast scheme of things and events, filling up the gaps (inevitable to the intermittent attentions of a finite consciousness) by the help of inference. This inference is verified by subsequent perceptions.

What reason have we then for supposing that the data of our perceptions are not parts of objective reality, and that this constructed scheme of things and events is not a true account of objective reality itself?

It cannot be denied that such a world as is given by this scheme would at least be possible, and equivalent for all practical purposes to the reality that we know. Moreover this is just the kind of world that the data of perception would naturally lead us to expect. It is claimed, however, that our knowledge of change does not come from perception and that we *know* objective reality to be a process of change by immediate acquaintance more direct even than perception. If we compare the description of change offered by mathematics with this direct knowledge of it, we find that the description does not describe change at all: it leaves out the essential thing, the process.

It seems then, that we have reached a dead-lock. Even if we assume that we have this direct knowledge of the process of change, we cannot describe it any further. The difficulty is to see how thought and language can apply to this direct knowledge (even sup-

posing we have it). If change is indefinable what is it that we do when we think we are thinking about it and describing it?

To begin with, thought and language can create symbols to direct our attention to experiences *about* which we cannot think. The concept and the word "change" are such symbols. If it be assumed that we can know change itself, the process, though we cannot think about it or describe it, then at least symbols can direct our attention to our immediate knowledge of it. They are its proper name and cause us to think and talk *of* it. (By *thinking of* it I mean attending to our immediate knowledge of it.)

But thought can do more than this. Besides thinking *of* change, we seem also to be able to think *about* it.

Even admitting that all attempts to define change would prove unsatisfactory compared with our immediate knowledge of real change (on the assumption that we have such knowledge), still a series of states does seem to be in some way equivalent to real change. But how can any definition be equivalent to an indefinable? The truth seems to be that when we think we are thinking and talking *about* change *in process* we are really only thinking and talking *about completed change.*

In what sense thinking *about* completed change will do instead of thinking about change in process is a further question which need not be discussed here. Enough has been said to show why Bergson considers the mathematical explanation of change unsatisfactory and why he assumes that change is a process. This assumption is the fundamental point in his theory of change. The objection to Mr. Russell's criticism here was that he never discussed this assumption.

His criticism of duration seems open to a similar charge. Besides the asumption that real change is a process Bergson's notion of duration involves the assumption that there is such a thing as real creation. This assumption, like the other, Mr. Russell passes over in silence. Bergson thinks that all process of change is creative. In fact whenever he has proved that there is process, he seems to think he must necessarily also have proved creation. In this I cannot agree. I can see no logical implication between being a process and being creative. The truth seems to be that Bergson has not realized quite clearly that process and creation are two different things. He speaks of process as if it *meant* creation.

Now, of these two notions the really important one is creation. The question of process alone does not seem to matter very much.

Process of change may not *be* a series of states but it can perfectly well be represented by one. What is really important therefore is to show that some real change, whether it be indivisible or not, is *creative.*

The case here is very similar to that of change. Bergson claims that we have immediate knowledge of creation as well as of change. The act of creation itself, like the process of change is indefinable. All that we can describe is *the created.*

The created may be described by a series of states in which, if any two states be considered, the later will always differ from the earlier just *because* the earlier one preceded it, even though all the other circumstances were the same in the two cases. (This "because" here simply means that their position in the time series is the only circumstance different for the two states, and must therefore be assumed as the ground of their difference.) In the case of such a series you would never get exactly similar repetitions *in the same series,* even if the outward circumstances were exactly similar.

Now, as we have seen, a series of states can only describe *the created* and never the *act of creating.* As in the case of the process of change, so here too mathematicians deny that there is such a thing as the act of creating.

They say that a series of states such as has been described is all that we *mean* by creation. Bergson, on the other hand, asserts that we have immediate knowledge of creation in the case of memory. No answer which ignores this assertion can really touch Bergson's position.

Let us now return to Mr. Russell's criticisms.

Mr. Russell tells us that "Bergson's theory of duration is bound up with his theory of memory. According to this theory things remembered survive in memory, and thus interpenetrate present things: past and present are not mutually external, but are mingled in a unity of consciousness."

Mr. Russell's argument is that the proof of Bergson's theory that in duration the past mingles with the present depends upon his being able to show that such a mingling actually occurs in memory. He then proceeds to show that Bergson's theory that the past mingles with the present in memory rests upon a confusion. In this way he considers that he has refuted Bergson's theory of duration.

Now it is true that Bergson's theory of creation rests upon his

theory of memory. When Bergson says that, in duration, the past mingles with the present, what he really means is that duration is a creative process of change, and to prove this assertion he has first to show that there are such things as process of change and creation, in reality. He claims that we have immediate knowledge of process in any period of consciousness, and of creation as well as process in memory. Memory is the clearest possible instance of creative process that Bergson can find, and, unless such an instance can be found, the theory of duration collapses. If, therefore, Mr. Russell could show that Bergson is wrong in supposing memory to be an instance of a creative process of change, he would have destroyed the best grounds for the theory that in duration the past mingles with the present.

His argument against Bergson's theory of memory is that "when Bergson speaks of the past he does not really mean the past, but our present memory of it," and again, "the real past Bergson simply forgets; what he speaks of is the present idea of the past."

Mr. Russell believes that Bergson's whole theory that in memory the past survives in the present rests upon a failure to distinguish the past from the *idea* of the past. Bergson is supposed to fancy that because our idea of the past is present, therefore the past itself must be present. As it stands this criticism does not really apply to what Bergson means by memory.

To establish his theory of duration what Bergson has to show is that we have knowledge of some instance in which the past mingles with the present in the senses: (*a*) that the past and present are undivided so that they form a process of changing, as opposed to a series of distinct units joined by relations; (*b*) that this past *creates* the present, in the sense that the fact that the present follows just that particular past makes it the sort of present it is.

Bergson holds that introspection gives us this knowledge. He claims that by attending to our own consciousness through a period of its duration we can satisfy ourselves that it forms a process of change. This gives us our instance of a process, and here the question of any present idea of the past does not enter in. Bergson also claims that by attending to the way in which our own character is modified by past experience we can become directly acquainted with an instance of creation. The modification of the present by the force of past experience is what Bergson means by memory, when he uses it to illustrate creation. This need not involve any

conscious ideas at all, so there can be no question here either of confusion of the past with our present ideas of it.

The theory that the past mingles with the present in the sense that past and present form one creative process (which is Bergson's theory of duration) rests then simply on the evidence of introspection. All we are required to do is to attend to the workings of our own consciousness without having recourse to ideas at all. The truth is we are only concerned here with the continuous change of consciousness itself, not even with ideas, and still less with the objective reality about which we have ideas. The only past with which we are concerned is the past of our own consciousness. What is claimed is that this forms one process, continuous with our present consciousness, and *creating* it. Our present idea of the past, therefore, does not come into the question. If Bergson is right in his assertion that we have knowledge of a creative process in our own consciousness, then consciousness has duration. Mr. Russell has not succeeded in showing that Bergson is wrong.

His criticisms of Bergson's efforts to define past and present are more just. Such definitions as "the past is that which acts no longer, and the present is that which is acting" certainly do assume the distinctions which they set out to explain. The truth seems to be that Bergson is so much interested in his discovery that the past acts in the present that he forgets that it is still nevertheless past. And yet that really is the interesting point. It is just because it *is* the past and not simultaneous with our present consciousness that the fact of its acting on that consciousness is so interesting.

To assume the distinction between past and present as already known, however, is not necessarily to assume *mathematical* time, as Mr. Russell claims. Mathematical time is an infinite series of moments in relations of before and after to each other. The assumption of a distinction between before and after does not necessarily involve a series of this sort. Mere change in quality need not form a series. Supposing pastness were a quality like redness. An event could become gradually more and more past just as a sunset can become more and more red. It is not true therefore that Bergson's condemnation of mathematical time is necessarily contradicted by his attempt to define past and present. Still it must be confessed that the definitions offered are, as they stand, circular and thus worthless.

We may now return to Bergson's identification of subject and object in his account of direct perception.

Mr. Russell maintains that Bergson's theory of perception is due to a failure to distinguish between subject and object in direct perception. He bases his criticism mainly on Bergson's statement that everything we know consists of "images."

What Bergson means by an "image" it is not very easy to define. He says it is "an existence placed half-way between the *thing* and the representation." He certainly does not mean a sensible image, so there is nothing odd in his calling the brain an image, though it has never been imaged.

An image is not the reality of which Bergson claims that we have an immediate knowledge. This knowledge, or experience, is what he calls "intuition." Neither is it a datum of perception, which he considers to be already a mere equivalent symbol which we have made for ourselves. It will be clearest to quote what he says about it himself in his article on "L'intuition philosophique" (*Revue de Métaphysique et de Morale,* Nov. 1911, pp. 810-811). He has been speaking of the intuition of reality from which philosophers start. He holds that all their complicated systems are simply attempts to describe this direct knowledge of what reality is. He now asks:[2] "Quelle est cette intuition? Si le philosophe n'a pas pu en donner la formule, ce n'est pas nous qui y réussirons. Mais ce que nous arriverons à ressaisir et à fixer, c'est une certaine image intermédiaire entre la simplicité de l'intuition concrète et la complexité des abstractions qui la traduisent, image fuyante et évanouissante, qui hante, inaperçue peut-être, l'esprit du philosophe qui le suit comme son ombre à travers les tours et détours de sa pensée, et qui, si elle n'est pas l'intuition même, s'en rapproche beaucoup plus que l'expression conceptuelle nécessairement symbolique, à laquelle l'intuition doit recourir pour fournir des 'explications.'"

It is not really in the "image" at all, therefore, that subject and object are identified—it is in the intuition—the direct knowledge of reality. This intuition is simply our immediate experience. Bergson believes that here the experiencing *is* the reality experienced.

[2] "What is this intuition? If philosophers have not succeeded in finding a definition for it, we are not likely to succeed in finding one. But what we can succeed in capturing and holding before our attention is a certain image, which stands half way between the simplicity of concrete intuition and the complexity of the abstractions which translate it, an elusive image, always on the point of disappearing, which haunts the mind of the philosopher, unknown even to himself perhaps, which follows his mind like its own shadow through the twistings and turnings of thought, and which, if it is not the intuition itself, is much nearer to it than the conceptual expression which is of necessity symbolic, but to which we are forced to resort when we want to supply 'explanations.'"

In the case of our own consciousness as we experience it, before we try to describe it, we do seem to *be* what we experience. I am inclined to think that Bergson believes that it is only our senses and our brains that prevent us from experiencing the whole of reality in the same way, and so *being* it.

This notion is certainly not easy to state but it is equally true that it is no use to criticize it until its meaning has been grasped: there is here no question of a confusion from failure to distinguish, but a deliberate rejection of a distinction fully realized in favor of a single notion held to be more fundamental than the distinction. In any case the confusion, if there were any, would belong to Bergson's notion of intuition. Mr. Russell does not discuss this notion. The question of what Bergson means by "images," which Mr. Russell does discuss, is not really relevant to Bergson's identification of subject and object.

In his last paragraph Mr. Russell accuses Bergson of caring only for action and scorning contemplation. "The good which Bergson hopes to see realized in the world is action for the sake of action. All pure contemplation he calls 'dreaming,' and condemns by a whole series of uncomplimentary epithets: static, Platonic, mathematical, logical, intellectual."

This cannot be allowed to pass. It is too complete a misrepresentation. At the least, Bergson cannot be held answerable to two contradictory charges. It is well known that he denies that the intellect can give us true knowledge of reality because it is preoccupied with action, and selects from reality only such aspects as are useful for furthering action. Since preoccupation with action describe this direct knowledge of what reality is. He now asks: is the ground on which he discredits intellect, it is surely not fair to accuse him of regarding action as the supreme good, and preferring it to contemplation. On the contrary Bergson only criticizes the attempts which the intellect makes at pure contemplation on the ground that even here it is necessarily falsified by being unable to throw off its bias towards action. According to Bergson the intellect developed originally in order to guide our choice of actions by the light of previous experience. It was made to see reality symbolically as made up of things and relations, because only the experience of 'things' which can be recognized as recurring, is useful for this purpose. Even when it turns away from its practical function towards contemplation, Bergson holds that it cannot throw off this predisposition.

Those who seek real contemplation must therefore abandon the intellect. Intellect will never give them wholly disinterested knowledge. This is why Bergson tells us to give up trying to get knowledge of reality by way of conceptual thought, and make instead the great effort which pure intuition demands, not because he despises pure speculation but just because he prizes it so highly.

If the reality which pure intuition reveals should turn out in the end to be mere "activity without purpose" not "inspired by some vision, some imaginative foreshadowing of a world less painful, less unjust, less full of strife than the world of our every-day life ....," then, doubtless, only those who care more for truth than for a pleasing picture will welcome the new philosophy.

KARIN COSTELLOE.

LONDON, ENGLAND.

"MULTIPLICATION OF PEARS AND PENCE."

Under the caption, "Multiplication of Pears and Pence," a letter by Mr. Frederic Hovenden is discussed in the October *Monist,* and it is suggested that "some one who believes in algebra" may be found who is willing to defend the use of concrete operators or of concrete numbers in equations.

The fact is that not only are concrete operators and complex units perfectly logical, but in each of the three lines in which arithmetic and algebra are actually used men have come to use concrete operators incessantly, and they *think* in complex units. These three lines are engineering, science and business. Feet per second, ton-miles, cents per yard, watthours, acre-feet, car-miles, pounds per square inch, and a host of other complex units have long ago become single ideas.

Not only physicists and engineers but every one thinks in complex units. 60 mi./hr. is not 60 miles nor 60 hours, but it is 60 *units of velocity,* the unit being a *mile-per-hour.* A railroad hauling 50 tons 200 miles gets paid, not for 50 tons nor yet for 200 miles, but for

$$50 \text{ tons} \times 200 \text{ miles} = 10{,}000 \text{ ton-miles}.$$

The area of a rectangle 8×15 centimeters is

$$8 \text{ cm.} \times 15 \text{ cm.} = 120 \text{ sq. cm.}$$

If we buy 20 pears for 30 d. the cost of pears is

$$30 \text{ d.} \div 20 \text{ pears} = 1.5 \text{ d./pear}.$$

And again note that the cost of pears is not 30, nor 30 d., nor 20, nor 20 pears, nor 1.5, nor 1.5 d., but *it is* 1.5 *pence-per-pear.*

Says Professor John Perry, "If I were asked to multiply 2 tables by 3 chairs I would not refuse. I would say 6 chair-tables. But if I were asked to say what I mean by a chair-table I would refuse, because nobody has ever given a meaning to the term. But I do know that when this sort of thing comes into a Physical Problem we can always give a useful meaning."[1]

One may also point to the "method of dimensions" so much used in checking formulas, etc. in physics and engineering, by writing out the "dimensions" of the quantities on each side of the equation in terms of length, mass, and time, or the like, to see whether the number of times these quantities appear, is the same on the two sides of the equation. One of the most remarkable points in the history of science is the rôle which dimensions have played in the development of electromagnetic theory. Electric and magnetic quantities may be measured in either of two systems, yet the "dimensional formulas" are not the same in the two systems but have the ratio (length ÷ time), which is a velocity. In Maxwell's electro-magnetic theory this velocity is the velocity of light. Experiment has shown this to be true, so that the study of dimensions in equations, that is of concrete multipliers and divisors, has played a most important part in the development of the theory.

To one who has not followed the powerful methods of vector analysis as applied to physics, it is really surprising to learn the extent to which this matter of complex units is carried. Not only does a single symbol represent a very complex unit, but its direction in space is also included in it. Yet the whole complex unit, together with the direction cosines determining its direction in space, becomes a single idea.

From a philosophical standpoint there can be no objection to a complex unit, or to concrete operators, and to one who is accustomed to take a pragmatic attitude of mind, it is decidedly desirable to use them since clearness is surely added by doing so.

Great harm has been done the cause of education by insisting that operators should be abstract.[2] The demand of the pure mathematicians who have written so many of the elementary text-books,

[1] John Perry, *Practical Mathematics,* London, 1899.

[2] For a discussion of the matter from a pedagogical standpoint, see a paper by P. G. Agnew, "Should Concrete Multipliers and Divisors be Allowed?" *Popular Educator,* 28, p. 229, January, 1811.

and the insistence on the part of teachers on set forms of analysis have brought this about. The following example is probably a fair average of the methods actually in use in the schools:

"If 5½ yards cost 99 cents, the *number* of cents per yard which the cloth costs is the *number* of times 5½ is contained in 99, or 18."

Who can say that such a benumbing circumlocution makes the matter clearer to the child's mind, (or to an adult mind other than that of a pure mathematician), than merely to say

$$99 \text{ cents} \div 5\tfrac{1}{2} \text{ yards} = 18 \text{ cents per yard?}$$

The latter presents the whole process of reasoning, both logic and details in a single step.

P. G. AGNEW.

BOOK REVIEWS.

THE ALCHEMY OF THOUGHT. By *L. P. Jacks.* New York: Holt, 1911. Pp. 349. Price $3.00 net.

The *Hibbert Journal* has been before the public for a number of years. It has stood for progress in religion as well as in philosophy, and the latest movements have found an exposition in its columns. Upon the whole one may trace in it the influence of Martineau, the prophet of unitarianism, and also the pragmatism, or indeed pluralism, of Professor James and his adherents. We have now before us a collection of essays written by L. P. Jacks, editor of the *Hibbert Journal,* who at the same time is Dean of Manchester College, Oxford, a dissenter institution. To characterize the tendency of Mr. Jacks we will quote from his preface in his own words:

"To say that the universe is a rational whole appears to me true. But to treat this as an adequate account of reality appears to me false. I am equally averse to regarding the rationality of the universe as the fundamental or all-inclusive or even the dominant form of its self-expression.

"What does form a rational whole and is adequately described by this term is the movement of thought throughout the ages—in a word, the history of philosophy. To equate this movement with the universe to which it refers, to makes the history of philosophy into a history of reality, appears to me an error.

"We are constantly tempted to make this equation, and constantly prevented from seeing its falsity, by the habit of treating speculative thought as a form of *ours* into which all experience must manage to fit itself. An important step towards liberation from this habit was taken by Spinoza, who treated thought as one among the infinite and eternal forms of the self-expression of substance—as one and one only. The benefits of this liberty, which relieve the mind from a very great burden, were largely sacrificed in the subsequent developments of Spinoza's doctrine.

"In much that follows I have repeated what is now common among Pluralists."

Mr. Jacks tempers his pluralism by not denying that "the universe does express itself as a rational whole." He only contends that the universe expresses itself in many ways other than rationally. Mr. Jacks continues:

"Pluralism has lost much of the strength it would otherwise have by denying, or seeming to deny, that the universe does express itself in many ways other than those which fit into the forms of conceptual logic. It is certainly true, as the Pluralists contend, that if the universe were nothing but a rational

whole—taking rational in its strict sense—the richness and variety of life would vanish and freedom would be impossible. On the other hand, if the universe were not rational, and were incapable of expressing itself in that form—if, that is, reality were forbidden by its inner constitution from taking that one among all the forms of a possible self-expression—it is equally plain that the world would be no place for beings constituted as we are.

"It will be said, no doubt, that this last statement is itself an appeal to rationality. This rejoinder, common as it has now become, merely serves to remind us once more of the saying that logic is a 'dodge.' As James has pointed out, the word 'rational' is a multidimensional term, and the constant effort of rationalism to confute all critics out of their own mouths appears to succeed only because rationalists expand the meaning of the term 'rational' with every step in the progress of their opponents' argument, and thus make it serve the changing purpose of their own."

Mr. Jacks takes a position which at first sight appears diametrically opposed to our own, for we insist most vigorously on the objective significance of science. We believe that the only philosophy (the word philosophy is here taken in its strictest sense) is "the philosophy of science." There may be innumerable different philosophies in the sense of subjective attitudes, but there is only one "philosophy of science" describing the constitution of the world and of human cognition in objective terms and arguments which are or ought to be as rigid as any of the sciences, as rigid as mathematics so far as they are purely formal, and as objective as chemistry so far as they refer to facts of experience. But while insisting on the objectivity of scientific thought, including the realm which is common to all sciences and forms their foundation, commonly called "philosophy," we not claim that the scientific world-conception is the only aspect. If the constitution of the world were not consistent in itself, reason and rational beings would be impossible, but we insist that the cosmic constitution is in itself consistent and forms an orderly whole from which reason naturally originates so as to suggest the assumption that life everywhere will tend to produce rational beings such as we are. But for all that, the development of reason is only one possible product among many others. This world does not produce rational beings only, it also produces animals, sentient beings, and unconscious organisms such as plants. All these existences are dominated by the law of consistency. Everything can be classified in uniformities, and with the help of the formal sciences we can comprehend all events in history as well as in the processes of nature. Nevertheless the scientific conception of the universe is only one view among several. The artist's view is another, which in its fundamental principle has nothing to do with an intellectual comprehension. The religious view of faith, the mystic dream of the devotee and even of the hazy visionary, the sentimentalist's longing are all as much justified as the scientist's conception. Within the realm of the human soul they are all as real and effective as, yea sometimes more powerful than, the figures of exact science. The writer has always insisted on this variety of view-points and gave an expression of it in his little pamphlet *The Philosophy of Form* as follows:

"A philosopher must not be a one-sided intellectualist. He must bear in mind that the noetic operations of man's mind are only one feature of his life; man is also endowed with sentiment, a sense of beauty, fancy, humor,

and above all he is an actor, a doer, a worker. Man is a struggling creature who must make a living; he is not a mere thinker, his thoughts serve the purpose of lief; they must be applied to the tasks which he has to accomplish in maintaining his existence and earning a livelihood. Philosophy is not mere theory; it serves the practical purpose of teaching us about the world we live in and offers suggestions as to how we are to live and to act. aMn takes delight also in giving expression to his sentiments by depicting in poetry and in art the motives that sway his soul. It would be a serious defect in a philosophy if it attempted to be purely intellectual and ignored religion, literature, the arts and music. The intellectual side is of the utmost significance and quite indispensable for the highest type of man. We must consider that only by his reason has man worked himself out of the brute state. We can never produce a better and a higher age without cultivating a scientific insight, but science is not the goal. It is only the means to the end of lifting humanity to a higher plane. We boldly maintain that a science which does not seek to ennoble the entire man is not the right kind of science. Sentiment must not be neglected any more than the intellectual faculties if we are to bring humanity to its highest and fullest expression."

Pragmatism has an anti-scientific tendency. So far as pragmatism in its positive tenets maintains that there are other view-points possible than that of intellectual comprehension, it is in its way right; but as soon as it denies science itself and would degrade it into a mere subjective attitude which is in constant subjection to reversal, it becomes a reactionary movement which will work as a brake on the wheel of progress wherever it is accepted.

Pragmatism in our opinion has gone too far in denying the objectivity of science and opposing the authority of science in its own realm. Here as well as elsewhere we must render to science that which belongs to science, to sentiment and religion, to art and to mysticism, what is theirs. True enough, science pervades all, and everything can become an object of scientific investigation; but on the other hand even science itself (or perhaps better, scientific aspirations, or the rejoicings in scientific results) may become an object of poetry. In the same way religion as well as art may in their way become as all-pervading as the cosmic order is omnipresent throughout all existence.

VOL. XXIV. APRIL, 1914 NO. 2

THE MONIST

ON THE NATURE OF ACQUAINTANCE.

II.

NEUTRAL MONISM.

"NEUTRAL MONISM" — as opposed to idealistic monism and materialistic monism—is the theory that the things commonly regarded as mental and the things commonly regarded as physical do not differ in respect of any intrinsic property possessed by the one set and not by the other, but differ only in respect of arrangement and context. The theory may be illustrated by comparison with a postal directory, in which the same names come twice over, once in alphabetical and once in geographical order; we may compare the alphabetical order to the mental, and the geographical order to the physical. The affinities of a given thing are quite different in the two orders, and its causes and effects obey different laws. Two objects may be connected in the mental world by the association of ideas, and in the physical world by the law of gravitation. The whole context of an object is so different in the mental order from what it is in the physical order that the object itself is thought to be duplicated, and in the mental order it is called an "idea," namely the idea of the same object in the physical order. But this duplication is a mistake: "ideas" of chairs and tables are identical with chairs and tables, but are

considered in their mental context, not in the context of physics.

Just as every man in the directory has two kinds of neighbors, namely alphabetical neighbors and geographical neighbors, so every object will lie at the intersection of two causal series with different laws, namely the mental series and the physical series. "Thoughts" are not different in substance from "things"; the stream of my thoughts is a stream of things, namely of the things which I should commonly be said to be thinking *of*; what leads to its being called a stream of *thoughts* is merely that the laws of succession are different from the physical laws. In my mind, Cæsar may call up Charlemagne, whereas in the physical world the two were widely sundered. The whole duality of mind and matter, according to this theory, is a mistake; there is only one kind of *stuff* out of which the world is made, and this stuff is called mental in one arrangement, physical in the other.[1]

A few quotations may serve to make the position clearer. Mach says (*op. cit.*, p. 14):

"That traditional gulf between physical and psychological research, accordingly, exists only for the habitual stereotyped method of observation. A color is a physical object so long as we consider its dependence upon its luminous source, upon other colors, upon heat, upon space, and so forth. Regarding, however, its dependence upon the retina...., it becomes a psychological object, a sensation. Not the subject, but the direction of our investigation, is different in the two domains."

"The primary fact is not the *I*, the ego, but the ele-

[1] For statements of this theory, see William James, *Essays in Radical Empiricism*, Longmans, 1912, especially the first of these essays, "Does 'Consciousness' Exist?" See also Mach, *Analysis of the Sensations*, Chicago, 1897 (the original was published in 1886). Mach's theory seems to be substantially the same as James's; but so far as I know James does not refer to him on this subject, so that he must have reached his conclusions independently of Mach. The same theory is advocated in Perry's *Present Philosophical Tendencies* and in *The New Realism* (1912).

ments (sensations). The elements *constitute* the *I*. *I* have the sensation green, signifies that the element green occurs in a given complex of other elements (sensations, memories). When *I* cease to have the sensation green, when *I* die, then the elements no longer occur in their ordinary, familiar way of association. That is all. Only an ideal mental-economical unity, not a real unity, has ceased to exist.

"If a knowledge of the connection of the elements does not suffice us, and we ask, *Who* possesses this connection of sensations, *Who* experiences the sensations, then we have succumbed to the habit of subsuming every element (every sensation) under some unanalyzed complex" (pp. 19-20).

"Bodies do not produce sensations, but complexes of sensations (complexes of elements) make up bodies. If to the physicist bodies appear the real abiding existences, while sensations are regarded merely as their evanescent transitory show, the physicist forgets, in the assumption of such a view, that all bodies are but thought-symbols for complexes of sensations (complexes of elements)" (p. 22).

"For us, therefore, the world does not consist of mysterious entities, which by their interaction with another equally mysterious entity, the ego, produce sensations which alone are accessible. For us, colors, sounds, spaces, times, ... are the ultimate elements, whose given connection it is our business to investigate" (p. 23).

Mach arrived at his opinions through physics. James, whose opinions are essentially the same, arrived at them through psychology. In his *Psychology* they are not yet to be found, though there is a certain approach to them. The various articles containing the opinions which concern us at present are collected in the posthumous book called

Essays in Radical Empiricism. The following quotations will, I hope, serve to make it clear what these opinions are.

" 'Consciousness,' " says James, "is the name of a non-entity, and has no right to a place among first principles. Those who still cling to it are clinging to a mere echo, the faint rumor left behind by the disappearing 'soul' upon the air of philosophy. For twenty years past[2] I have mistrusted 'consciousness' as an entity; for seven or eight years past I have suggested its non-existence to my students, and tried to give them its pragmatic equivalent in realities of experience. It seems to me that the hour is ripe for it to be openly and universally discarded.

"To deny plumply that 'consciousness' exists seems so absurd on the face of it—for undeniably 'thoughts' do exist—that I fear some readers will follow me no farther. Let me then immediately explain that I mean only to deny that the word stands for an entity, but to insist most emphatically that it does stand for a function. There is, I mean, no aboriginal stuff or quality of being, contrasted with that of which material objects are made, out of which our thoughts of them are made; but there is a function of experience which thoughts perform, and for the performance of which this quality of being is involved. That function is *knowing*" (pp. 2-4).

"My thesis is that if we start with the supposition that there is only one primal stuff or material in the world, a stuff of which everything is composed, and if we call that stuff 'pure experience,' then knowing can easily be explained as a particular sort of relation towards one another into which portions of pure experience may enter. The relation itself is a part of pure experience; one of its 'terms' becomes the subject or bearer of the knowledge, the knower, the other becomes the object known" (p. 4).

After explaining the view, which he rejects, that ex-

[2] This article was first published in 1904.

perience contains an essential opposition of subject and object, he proceeds:

"Now my contention is exactly the reverse of this. *Experience, I believe, has no such inner duplicity: and the separation of it into consciousness and content comes, not by way of subtraction, but by way of addition*—the addition, to a given concrete piece of it, of other sets of experiences, in connection with which its use or function may be of two different kinds. The paint will also serve here as an illustration. In a pot in a paint-shop, along with other paints, it serves in its entirety as so much saleable matter. Spread on a canvas, with other paints around it, it represents, on the contrary, a feature in a picture and performs a spiritual function. Just so, I maintain, does a given undivided portion of experience, taken in one context of associates, play the part of a knower, of a state of mind, of 'consciousness'; while in a different context the same undivided bit of experience plays the part of a thing known, of an objective 'content.' In a word, in one group it figures as a thought, in another group as a thing. And, since it can figure in both groups simultaneously, we have every right to speak of it as subjective and objective both at once" (pp. 9-10; the italics are in the original).

"Consciousness connotes a kind of external relation, and does not denote a special stuff or way of being. *The peculiarity of our experiences, that they not only are, but are known, which their 'conscious' quality is invoked to explain, is better explained by their relations—these relations themselves being experiences—to one another*" (p. 25; the italics are in the original).

James explains, a few pages later, that a vivid image of fire or water is just as truly hot or wet as physical fire or water. The distinction, he says, lies in the fact that the imagined fire and water are not causally operative like the "real" fire and water. "Mental fire is what won't burn

real sticks; mental water is what won't necessarily (though of course it may) put out even a mental fire. Mental knives may be sharp, but they won't cut real wood" (p. 33).

"The central point of the pure-experience theory is that 'outer' and 'inner' are names for two groups into which we sort experiences according to the way in which they act upon their neighbors. Any one 'content,' such as *hard*, let us say, can be assigned to either group" (p. 139).

Finally he comes to the alleged introspective certainty of consciousness. But his introspective deliverance is not the usual one. In himself, he says, "the stream of thinking (which I recognize emphatically as a phenomenon) is only a careless name for what, when scrutinized, reveals itself to consist chiefly of the stream of my breathing. The 'I think' which Kant said must be able to accompany all my objects, is the 'I breathe' which actually does accompany them. There are other internal facts besides breathing.... and these increase the assets of 'consciousness' so far as the latter is subject to immediate perception; but breath, which was ever the original of 'spirit,' breath moving outwards, between the glottis and the nostrils, is, I am persuaded, the essence out of which philosophers have constructed the entity known to them as consciousness" (p. 37).

In order to understand James's theory, it is necessary to consider more in detail his account of 'knowing.' Mere seeing and hearing, and sensation generally, he does not call 'knowing.' In all the cases where those who hold a different theory would say we have *direct* knowledge, there is, in James's view, no knowledge at all, but merely the presence of the thing itself as one of the constituents of the mind which is mistakenly supposed to know the thing. Knowing, according to him, is an external relation between two bits of experience, consisting in the fact that one of them leads to the other by means of certain intermediaries.

The following illustration aptly introduces his account of knowing:

"Suppose me to be sitting here in my library at Cambridge, at ten minutes' walk from 'Memorial Hall,' and to be thinking truly of the latter object. My mind may have before it only the name, or it may have a clear image, or it may have a very dim image of the hall, but such intrinsic differences in the image make no difference in its cognitive function. Certain *extrinsic* phenomena, special experiences of conjunction, are what impart to the image, be it what it may, its knowing office.

"For instance, if you ask me what hall I mean by my image, and I can tell you nothing; or if I fail to point or lead you towards the Harvard Delta; or if, being led by you, I am uncertain whether the hall I see be what I had in mind or not; you would rightly deny that I had 'meant' that particular hall at all, even though my mental image might to some degree have resembled it. The resemblance would count in that case as coincidental merely, for all sorts of things of a kind resemble one another in this world without being held for that reason to take cognizance of one another.

"On the other hand, if I can lead you to the hall, and tell you of its history and present uses; if in its presence I feel my idea, however imperfect it may have been, to have led hither and to be now *terminated*; if the associates of the image and of the felt hall run parallel, so that each term of the one context corresponds serially, as I walk, with an answering term of the other; why then my soul was prophetic, and my idea must be, and by common consent would be, called cognizant of reality. That percept was what I *meant*. . . .

"In this continuing and corroborating, taken in no transcendental sense, but denoting definitely felt transi-

tions, *lies all that the knowing of a percept by an idea can possibly contain or signify*" (pp. 54-56).

It will be observed that, according to the above account, he usually ceases to "know" Memorial Hall when he reaches it; he only "knows" it while he has ideas which lead or enable him to perceive it by taking suitable steps. It is, however, possible, apparently, to regard an experience as "knowing" itself in certain circumstances. In an enumeration of cases, James says:

"Either the knower and the known are:

"1. the self-same piece of experience taken twice over in different contexts: or they are

"2. two pieces of *actual* experience belonging to the same subject, with definite tracts of conjunctive transitional experience between them; or

"3. the known is a *possible* experience either of that subject or another, to which the said conjunctive transitions *would* lead, if sufficiently prolonged" (p. 53).

In a later illustration, he says:

"To call my present idea of my dog, for example, cognitive of the real dog means that, as the actual tissue of experience is constituted, the idea is capable of leading into a chain of other experiences on my part that go from next to next and terminate at last in vivid sense-perceptions of a jumping, barking, hairy body. Those *are* the real dog, the dog's full presence, for my common sense" (p. 198).

And again: "Should we ever reach absolutely terminal experiences, experiences in which we were all agreed, which were superseded by no revised continuations, these would not be *true*; they would be *real,* they would simply *be* . . . . Only such *other* things as led to these by satisfactory conjunctions would be 'true' " (p. 204).

Before proceeding to examine the substantial truth or falsehood of James's theory, we may observe that his use of the word "experience" is unfortunate, and points to the

lingering taint of an idealistic ancestry. This word is full of ambiguity; it inevitably suggests an experiencing subject; it hints at some common quality, "being experienced," in all the constituents of the world, whereas there is reason to believe that no such common quality is to be found. This word is abandoned by Professor Perry, whose chapters on "A realistic theory of mind" and "A realistic theory of knowledge"[3] give an admirable account of the Mach-James hypothesis. Nevertheless, even in his account, as in the whole doctrine, it seems possible to detect the unconscious influence of an idealistic habit of mind, persisting involuntarily after the opinions upon which it was based have been abandoned. But this can only be made clear by a detailed examination of the grounds for and against the whole theory of neutral monism.

In favor of the theory, we may observe, first and foremost, the very notable simplification which it introduces. That the things given in experience should be of two fundamentally different kinds, mental and physical, is far less satisfactory to our intellectual desires than that the dualism should be merely apparent and superficial. Occam's razor, *"entia non multiplicanda praeter necessitatem,"* which I should regard as the supreme methodological maxim in philosophizing, prescribes James's theory as preferable to dualism if it can possibly be made to account for the facts. Again, "matter," which in Descartes's time was supposed to be an obvious datum, has now, under the influence of scientific hypotheses, become a remote super-sensuous construction, connected, no doubt, with sense, but only through a long chain of intermediate inferences. What is immediately present in sense, though obviously in some way presupposed in physics, is studied rather in psychology than in physics. Thus we seem to have here, in sense, a neutral ground, a watershed, from which we may pass either to

[3] Chaps. XII and XIII of *Present Philosophical Tendencies.*

"matter" or to "mind," according to the nature of the problems we choose to raise.[4]

The ambiguous status of what is present in sense is illustrated by the difficulties surrounding the notion of "space." I do not intend now to attempt a solution of these difficulties; I wish only to make them felt, lest it should seem as though space afforded a clear distinction between the material and the mental. It is still sometimes thought that matter may be defined as "what is in space," but as soon as "space" is examined, it is found to be incredibly ambiguous, shifting and uncertain. Kant's *a priori* infinite given whole, which merely expresses our natural beliefs whenever the difficult disintegrations of analysis escape from our memories, has suffered a series of shattering blows from the most diverse quarters. The mathematicians have constructed a multiplicity of possible spaces, and have shown that many logical schemes would fit the empirical facts. Logic shows that space is not "*the* subject-matter of geometry," since an infinite number of subject-matters satisfy any given kind of geometry. Psychology disentangles the contributions of various senses to the construction of space, and reveals the all-embracing space of physics as the outcome of many empirically familiar correlations. Thus the space of actual experience is appropriated by psychology, the space of geometry is appropriated by logic, and the space of physics is left halting between them in the humbled garb of a working hypoth-

[4] The neutrality of sensation in orthodox philosophy may be illustrated by the following quotation from Professor Stout's *Manual of Psychology*, p. 133: "If we compare the color *red* as a quality of a material object with the color *red* as a quality of the corresponding sensation, we find that redness as immediately perceived is an attribute common to both. The difference lies in the different relations into which it enters in the two cases. As a quality of the thing, it is considered in relation to other qualities of the thing,—its shape, texture, flavor, odor, etc. As a psychical state, it is considered as a peculiar modification of the consciousness of the percipient, in relation to the general flow of his mental life." There seems in this passage an acceptance, as regards sensation, of the doctrines of neutral monism which Professor Stout would be far from adopting generally.

esis. It is not in "space," therefore, that we can find a criterion to distinguish the mental and the physical.

A large part of the argument in favor of neutral monism, as stated by its advocates, consists in a polemic against the view that we know the external world through the medium of "ideas," which are mental. I shall consider this view in the next part; for the present, I wish only to say that, as against this view, I am in agreement with neutral monism. I do not think that, when an object is known to me, there is in my mind something which may be called an "idea" of the object, the possession of which constitutes my knowledge of the object. But when this is granted, neutral monism by no means follows. On the contrary, it is just at this point that neutral monism finds itself in agreement with idealism in making an assumption which I believe to be wholly false. The assumption is that, *if anything is immediately present to me, that thing must be part of my mind.* The upholders of "ideas," since they believe in the duality of the mental and the physical, infer from this assumption that only ideas, not physical things, can be immediately present to me. Neutral monists, perceiving (rightly, as I think) that constituents of the physical world can be immediately present to me, infer that the mental and the physical are composed of the same "stuff," and are merely different arrangements of the same elements. But if the assumption is false, both these opposing theories may be false, as I believe they are.

Before attempting a refutation of neutral monism, we may still further narrow the issue. Non-cognitive mental facts—feeling, emotion, volition—offer *prima facia* difficulties to which James offers a *prima facie* answer. His answer might be discussed, and might prove tenable or untenable. But as we are concerned with the theory of *knowledge*, we will ignore the non-cognitive part of the problem, and consider only what is relevant to knowledge.

It is in this sphere that his theory is important to us, and in this sphere that we must make up our minds as to its truth or falsehood.

Apart from objections depending upon argument, there is an initial difficulty in the view that there is nothing cognitive in the mere presence of an object to the mind. If I see a particular patch of color, and then immediately shut my eyes, it is at least possible to suppose that the patch of color continues to exist while my eyes are shut; so far, James would agree. But while my eyes are open, the patch of color is one of the contents of my momentary experience, whereas when my eyes are shut it is not. The difference between being and not being one of the contents of my momentary experience, according to James, consists in experienced relations, chiefly causal, to other contents of my experience. It is here that I feel an insuperable difficulty. I cannot think that the difference between my seeing the patch of red, and the patch of red being there unseen, consists in the presence or absence of relations between the patch of red and other objects of the same kind. It seems to me possible to imagine a mind existing for only a fraction of a second, seeing the red, and ceasing to exist before having any other experience. But such a supposition ought, on James's theory, to be not merely improbable, but meaningless. According to him, things become parts of my experience in virtue of certain relations to each other; if there were not a system of interrelated things experienced by me, there could not be one thing experienced by me. To put the same point otherwise: it seems plain that, without reference to any other content of my experience, at the moment when I see the red I am acquainted with it in some way in which I was not acquainted with it before I saw it, and in which I shall not be acquainted with it when it ceases to be itself present in memory, however much I may be able to recall various facts which would enable me to

see it again if I chose. This acquaintance which I have with what is part of my momentary experience seems to deserve to be called cognitive, with a more indefeasible right than any connected ideas such as James describes in speaking of Memorial Hall.

I shall return to the above difficulty, which seems to me the main objection to neutral monism, when I come to consider how the contents of my momentary experience are to be distinguished from other things; in this connection, the difficulty will take a more general form, and will raise questions which can be better considered after various more detailed difficulties have been dealt with.

The first difficulty which seems to require an answer is as to the nature of *judgment* or *belief,* and more particularly of erroneous belief. Belief differs from sensation in regard to the nature of what is before the mind: if I believe, for example, "that to-day is Wednesday," not only no sensation, but no presentation of any kind, can give the same objective content as is involved in my belief. This fact, which is fairly obvious in the above instance, is obscured, I think, by the unconscious habit of dwelling upon existential beliefs. People are said to believe in God, or to disbelieve in Adam and Eve. But in such cases what is believed or disbelieved is that there is an entity answering to a certain description. This, which can be believed or disbelieved, is quite different from the actual entity (if any) which does answer to the description. Thus the matter of belief is, in all cases, different in kind from the matter of sensation or presentation, and error is in no way analogous to hallucination. A hallucination is a fact, not an error; what is erroneous is a judgment based upon it. But if I believe that to-day is Wednesday when in fact to-day is Tuesday, "that to-day is Wednesday" is not a fact. We cannot find anywhere in the physical world any entity corresponding to this belief. What idealists have

said about the creative activity of mind, about relations being due to our relating synthesis, and so on, seems to be true in the case of error; to me, at least, it is impossible to account for the occurrence of the false belief that to-day is Wednesday, except by invoking something not to be found in the physical world.

In *The New Realism*[5] there is an essay called "A realistic theory of truth and error," by W. P. Montague. It will serve to illustrate the argument if we examine what is said on error in the course of this essay.

"The true and the false," says Mr. Montague, "are respectively the real and the unreal, considered as objects of a possible belief or judgment" (p. 252).

There is nothing unusual in this definition, yet it suffers from a defect so simple and so fundamental that it is amazing how so many philosophers can have failed to see it. The defect is that there is no such thing as the unreal, and therefore, by the definition, there can be no such thing as the false; yet it is notorious that false beliefs do occur. It is possible, however, that Mr. Montague might maintain that there are unreal things as well as real ones, for with him "real" is definable. His definition is as follows:

"The real universe consists of the space-time system of existents, together with all that is presupposed by that system" (p. 255).

He proceeds at once to deduce his view of the unreal:

"And as every reality can be regarded as a true identity-complex or proposition, and as each proposition has one and only one contradictory, we may say that the remainder of the realm of subsistent objects [i. e., the unreal] must consist of the false propositions or unrealities, particular and universal, which contradict the true propositions comprising reality" (*ibid.*).

From the above it appears that, according to Mr. Mon-

[5] By the American Six Realists, New York and London, 1912.

tague, (1) every reality is a proposition; (2) false propositions subsist as well as true ones; (3) the unreal is the class of false propositions. We cannot now pursue these topics, which belong to logic. But for reasons which I have set forth elsewhere, it would appear (1) that *no* reality is a proposition, though some realities are beliefs, (2) that *true* propositions have a certain correspondence with complex facts, while false propositions have a different correspondence, (3) that the unreal is simply nothing, and is only identical with the class of false propositions in the same sense in which it is identical with the class of simoniacal unicorns, namely in the sense that both are null. It follows, if it is not otherwise obvious, that belief involves a different kind of relation to objects from any involved in sensation and presentation. The typical error to Mr. Montague, as to neutral monists generally, is the so-called "illusion of sense," which, as I shall try to show fully on another occasion, is no more illusory or erroneous than normal sensation. The kind of error with which we are all familiar in daily life, such as mistaking the day of the week, or thinking that America was discovered in 1066, is forced into the mould of "illusions of sense," at the expense of supposing the world to be full of such entities as "the discovery of America in 1066"—or in any year that the ignorance of schoolboys may suppose possible.

A further difficulty, not wholly unallied to the difficulty about error, concerns the thought of non-temporal entities, or the belief in facts that are independent of time. Whatever may be the right analysis of belief, it is plain that there are times at which I am believing that two and two are four, and other times at which I am not thinking of this fact. Now if we adopt the view that there is no specifically mental element in the universe, we shall have to hold that "$2 + 2 = 4$" is an entity which exists at those moments of time when some one is believing it, but not at

other moments. It is however very difficult to conceive of an abstract fact of this sort actually existing at certain times. No temporal particular is a constituent of this proposition; hence it seems impossible that, except through the intermediary of some extraneous temporal particular, it should acquire that special relation to certain moments which is involved in its being sometimes thought of and sometimes not. It is, of course, merely another form of the same difficulty that we shall be compelled, if we adopt neutral monism, to attribute causal efficacy to this abstract timeless fact at those moments when it is being believed. For these reasons, it seems almost inevitable to hold that my believing that $2 + 2 = 4$ involves a temporal particular not involved in the object of my belief. And the same argument, word for word, applies also to presentations when their objects are not temporal particulars.

An analogous problem arises in regard to memory. If I remember now something which happened an hour ago, the present event, namely my remembering, cannot be numerically identical with the event of an hour ago. If, then, my present experience involves nothing but the object experienced, the event which I am said to remember cannot itself be the object experienced when I remember. The object experienced must be something which might be called an "idea" of the past event. To this, however, there seem to be the same objections, if taken (as it would have to be) as applying to *all* memory, that there are to the doctrine that all contact with outside objects occurs through the medium of "ideas"—a doctrine against which neutral monism has arisen as a protest. If the past can never be directly experienced in memory, how, we must inquire, can it ever come to be known that the object now experienced in memory is at all similar to the past object? And if this cannot be known, the whole of our supposed knowledge of the past becomes illusory, while it becomes

impossible to account for the obvious difference between our knowledge as regards the past and our knowledge as regards the future.

An objection, possibly not unavoidable, applies to James's account of "processes of leading" as constituting knowledge. His definition of the sort of "leading" required is vague, and would include cases which obviously could not be called knowledge. Take, for example, the instance, quoted above, of James's knowledge of his dog, which consists in the fact that "the idea is capable of leading into a chain of other experiences on my part that go from next to next and terminate at last in vivid sense-perceptions of a jumping, barking, hairy body." Obviously a great deal is unexpressed in this account. The original idea must have somehow "intended" the jumping, barking, hairy body: some purpose or desire must be satisfied when the dog appears. Otherwise, an idea which had led to the dog by accident would equally be cognitive of the dog. It is in this way, I suppose, that James was led to the pragmatic theory of truth. Ideas have many effects, some intended, some unintended; they will be cognitive, according to James, when they have *intended* effects, when we have the feeling "yes, that is what I was thinking of." At this point, the need of a neutral theory of desire becomes very urgent; but we will not dwell on this difficulty. The purely cognitive aspect of James's view offers sufficient difficulties, and we will consider them only.

The relations of cause and effect, which James supposes to intervene between the antecedent knowledge of his dog and the dog's actual presence, will require some further definition; for unintended sequences of cause and effect, even if their final outcome were what is intended, could not be said to show that the original idea was cognitive. Suppose, for example, that I wish to be with my dog, and start towards the next street in hopes of finding him there;

but on the way I accidentally fall into a coal-cellar which he has also fallen into. Although I find him, it cannot be said that I knew where he was. And apart from this difficulty, the causal relation is an extremely obscure one. I do not believe the received notions on the subject of causality can possibly be defended; yet, apart from them, James's account of the cognitive relation becomes obscure. There is in James and in some of his followers a certain *naïveté* towards science, a certain uncritical acceptance of what may be called scientific common sense, which seems to me largely to destroy the value of their speculations on fundamental problems. The notion of "a *chain* of experiences that go from next to next," if introduced in the definition of cognition, seems to me to show an insufficiently critical attitude towards the notion of causality. But I am not at all sure that this is a *vital* objection to James's view: it is not unlikely that it could be avoided by a re-statement.

Another difficulty is that, in order to make his account of cognition fit all cases, he has to include *potential* processes of leading as well as actual ones. Of the three kinds of relation which, according to him, may subsist between knower and known, the third, we saw, is described as follows: "The known is a *possible* experience either of that subject or another, to which the said conjunctive transitions *would* lead, if sufficiently prolonged." It is true he says (p. 54): "Type 3 can always formally and hypothetically be reduced to type 2," and in type 2 both experiences are actual. But by the word "hypothetically" he re-introduces the very element of possibility which he is nominally excluding: *if* you did such-and-such things (which perhaps in fact you do not do), your idea *would* verify itself. But this is a wholly different thing from *actual* verification. And the truth of a possible or hypothetical verification involves, necessarily, considerations which must sweep away verification altogether as the *meaning* of truth. It

may be laid down generally that *possibility* always marks insufficient analysis: when analysis is completed, only the *actual* can be relevant, for the simple reason that there is only the actual, and that the merely possible is nothing.

The difficulties in the way of introducing precision into the account of James's "processes of leading" arise, if I am not mistaken, from his having omitted to notice that there must be a *logical* relation between what is believed in the earlier stages and what is experienced in the fulfilment. Let us revert to the instance of Memorial Hall. According to James, I should be said to "know" Memorial Hall if, for example, I know that it is reached by taking the first turning on the right and the second on the left and then going on for about 200 yards. Let us analyze this instance. In the case supposed, I know, or at least I believe truly, the following proposition: "Memorial Hall is the building which is reached by taking the first turning on the right and the second on the left, and then going on for 200 yards." For brevity, let us call this proposition *p*. The name "Memorial Hall," in this proposition, may be assumed to occur as a *description,* i. e., to mean "the building called 'Memorial Hall.'" It may occur as a proper name, i. e., as a name for an object directly present in experience; but in the case supposed, when it is being questioned whether I know Memorial Hall at all, it is more instructive to consider the occurrence of the name as a description. Thus *p* asserts that two descriptions apply to the same entity; it says nothing about this entity except that the two descriptions apply to it. A person may know *p* (for instance, by the help of a map) without ever having seen Memorial Hall, and without Memorial Hall having ever been directly present in his experience. But if I wish to discover whether the belief in *p* is true or not, two courses are open to me. I may either search for other propositions giving other descriptions of Memorial Hall,

such as that it comes at such and such a point on the map; or I may proceed to discover the actual entity satisfying one of the descriptions, and then ascertain whether it satisfies the other. The order, as between the two descriptions, is theoretically irrelevant; but it happens that one of the two descriptions, namely the one telling me the way, makes it easy to find the entity described. I may therefore take the first turning on the right and the second on the left and proceed for 200 yards, and then inquire the name of the building in front of me. If the answer is "Memorial Hall," the belief in *p* is verified. But it seems a misuse of terms to say that belief in *p*, when *p* is in fact true, constitutes knowledge of Memorial Hall. Belief in *p* is belief in a proposition of which Memorial Hall itself is not even a constituent; it may be entertained, on adequate grounds, by a person who has never experienced Memorial Hall; it may be rejected erroneously by a person who vividly remembers Memorial Hall. And when I actually see Memorial Hall, even if I do not know that that is its name, and even if I make no propositions about it, I must be said to know it in some sense more fundamental than any which can be constituted by the belief in true propositions describing it.

If what has been said is correct, certain points emerge as vital. First, that James and his followers, like many other philosophers, unduly assimilate belief to presentation, and thereby obscure the problem of error; secondly, that what they call knowledge of an object is really knowledge of a proposition in which the object itself does not occur, but is replaced by a *description* in terms of images or other constituents of actual present experience; thirdly, that what makes such a proposition true is the relations of the constituents of this actual proposition, relations which *may* be (but need not always be) established by the intermediary of the object described, but even then are not rela-

tions into which the actual object described enters as a term or constituent. Thus what James calls knowledge of objects is really knowledge of propositions in which the objects do not occur, but are replaced by descriptions; and the constituents of such propositions are contained in the present experience of the person who is believing them.

This brings us to the last objection which I have to urge against neutral monism, namely the question: How is the group of my present experiences distinguished from other things? Whatever may be meant by " my experience," it is undeniable that, at any given moment, some of the things in the world, but not all, are somehow collected together into a bundle consisting of what now lies within my immediate experience. The question I wish to consider is: Can neutral monism give a tenable account of the bond which unites the parts of this bundle, and the difference which marks them out from the rest of the things in the world?

This problem is incidentally discussed by Professor Perry in his *Present Philosophical Tendencies,* in the chapter called "A Realistic Theory of Mind." He emphasizes first the fact that the same thing may enter into two different people's experience, and that therefore one mind's objects are not necessarily cut off from the direct observation of another mind. So far, I should agree. But it does not follow, unless neutral monism is assumed (if then), that one man can directly know that a certain thing is part of another man's experience. A and B may both know a certain object O, but it does not follow that A knows that B knows O. Thus the fact that two minds may know the same object does not show that they are themselves accessible to each other's direct observation, unless they *are* simply the objects which constitute the contents of their experience. In that case, of course, they must be accessible to each other's direct observation. Pro-

fessor Perry regards a shrinking from this conclusion as a mere mistake, due to the fact that so many of our objects are internal bodily states which, for physical reasons, are hidden from other observers. I cannot think that he is right in this. Consider something in no way private: suppose I am thinking $3 + 3 = 6$. I can know directly that I am thinking this, but no other man can. Professor Perry says:

"If you are a psychologist, or an interpreter of dreams, I may 'tell' you what is in my mind. Now it is frequently assumed by the sophisticated that when I thus verbally reveal my mind you do not *directly* know it. You are supposed directly to know only my words. But I cannot understand such a supposition, unless it means simply that you know my mind only *after* and *through* hearing my words" (p. 290).

This passage appears to me to embody a logical error, namely a confusion of universals and particulars. The meanings of words, in so far as they are common to two people, are almost all universals. Perhaps the only exception is "now."[6] If I say "this," pointing to some visible object, what another man sees is not exactly the same as what I see, because he looks from a different place. Thus if he takes the word as designating the object which he sees, it has not the same meaning to him as to me. If he attempts to correct this, he will have to replace the immediate datum of his sight by a description, such as "the object which, from the point of view of my friend, corresponds with the object which I see." The words, therefore, in which I try to tell my experience will omit what is particular to it, and convey only what is universal. (I do not mean that it is *logically* impossible for two men to know the same particular, but only that practically it does not occur, owing to difference of point of view.) It may be

[6] Even this exception is open to doubt.

said, however, that this difficulty does not apply in the case of an abstract thought consisting wholly of universal or logical constituents. In that case, it is true, I can convey wholly the *object* of my thought; but even then, there is something which I cannot convey, namely that something which makes my thought a particular dated event. If I think, at a certain moment, that $3 + 3 = 6$, that is an event in time; if you think it at the same moment, that is a second event at the same time. There is thus something in my thought over and above the bare logical fact that $3 + 3 = 6$; and it is just this something which is partly incommunicable. When I tell you that I am thinking that $3 + 3 = 6$, I give you information even if you are not wholly ignorant of arithmetic. It is this further something, which makes the thought *my* thought, that we have to consider.

On this point, Professor Perry says:

"When I am thinking abstractions, the contents of my mind, namely the abstractions themselves, are such as you also may think. They are not possessed by me in any exclusive sense. And the fact that they are my contents means that they are somehow bound up with the history of my nervous system. The contents, and the linkage which makes them mine, are alike common objects, lying in the field of general observation and study" (p. 297).

The important sentence here is "the fact that they are my contents means that they are somehow bound up with my nervous system." The same idea is expressed elsewhere in the same chapter. "Elements become mental content," he says *"when reacted to in the specific manner characteristic of the central nervous system"* (p. 299, his italics). And again, more fully:

"A mind is a complex so organized as to act desideratively or interestedly. I mean here to indicate that character which distinguishes the living organism, having originally the instinct of self-preservation, and acquiring in

the course of its development a variety of special interests. I use the term *interest* primarily in its biological rather than its physiological sense. Certain natural processes act consistently in such wise as to isolate, protect, and renew themselves" (pp. 303-4).

But such an account of what makes a mind seems impossible to reconcile with obvious facts. In order to know that such and such a thing lies within my experience, it is not necessary to know anything about my nervous system: those who have never learned physiology, and are unaware that they possess nerves, are quite competent to know that this or that comes within their experience. It may be—I have no wish either to affirm or deny it—that the things which I experience have some relation to my nervous system which other things do not have; but if so, this must be a late scientific discovery, built up on masses of observation as to the connections of the object of consciousness with the nervous system and with the physical object. The distinction between things of which I am aware—for instance, between the things I see before my eyes and the things behind my back—is not a late, elaborate, scientific distinction, nor is it one depending upon the relations of these things to each other. So much, I thing, is clear to inspection; I do not know how to prove it, for I cannot think of anything more evident. But if so, then neutral monism cannot be true, for it is obliged to have recourse to extraneous considerations, such as the nervous system, in order to explain the difference between what I experience and what I do not experience, and this difference is too immediate for any explanation that neutral monism can give.

We may now sum up this long discussion, in the course of which it has been necessary to anticipate many topics to be treated more fully at a later stage. Neutral monism, we saw, maintains that there are not two sorts of entities,

mental and physical, but only two sorts of relations between entities, namely those belonging to what is called the mental order and those belonging to what is called the physical order. In favor of the theory, we may admit that what is experienced may itself be part of the physical world, and often is so; that the same thing may be experienced by different minds; that the old distinction of "mind" and "matter," besides ignoring the abstract facts that are neither mental nor physical, errs in regarding "matter," and the "space" in which matter is, as something obvious, given, and unambiguous, and is in hopeless doubt as to whether the facts of sensation are to be called physical or mental. In emphasizing all this, we must acknowledge that neutral monism has performed an important service to philosophy. Nevertheless, if I am not mistaken, there are problems which this theory cannot solve, and there are facts which it cannot account for. The theory has arisen chiefly as a protest against the view that external objects are known through the medium of subjective "ideas" or "images," not directly. But it shares with this view the doctrine that whatever I experience must be part of my mind; and when this doctrine is rejected, much of its plausibility ceases.

The first and chief objection against the theory is based on inspection. Between (say) a color seen and the same color not seen, there seems to be a difference not consisting in relations to other colors, or to other objects of experience, or to the nervous system, but in some way more immediate, more intimate, more intuitively evident. If neutral monism were true, a mind which had only one experience would be a logical impossibility, since a thing is only mental in virtue of its external relations; and correspondingly, it is difficult for this philosophy to define the respect in which the whole of my experience is different from the things that lie outside my experience.

A second difficulty is derived from *belief* or *judgment*, which James and his followers unduly assimilate to sensation and presentation, with fatal results as regards the theory of error. Error is defined as "belief in the unreal," which compels the admission that there actually are unreal things.

A third difficulty is that the thought of what is not in time, or a belief in a non-temporal fact, is an event in time with a definite date, which seems impossible unless it contains some constituent over and above the timeless thing thought of or believed. The same point arises in regard to memory; for if what is remembered actually exists in the remembering mind, its position in the time-series becomes ambiguous, and the essential pastness of the remembered object disappears.

A fourth difficulty arises in regard to the definition of knowledge offered by James, though here it is hard to say how far this definition is essential to neutral monism. James considers throughout rather knowledge of things than knowledge of truths, and he regards it as consisting in the presence of other things capable of leading to the thing which these other things are said to know. Immediate experience, which I should regard as the only real knowledge of things, he refuses to regard as knowledge at all; and it would seem that what he calls knowledge of a thing is really knowledge of a proposition of which the thing is not even a constituent.

In addition to the above difficulties, there is a fifth, more fatal, I think, than any of them, which is derived from considerations of "this" and "now" and "I." But this difficulty demands considerable discussion, and is therefore reserved for the next part.

For these reasons—some of which, it must be confessed, assume the results of future discussions— I conclude that neutral monism, though largely right in its

polemic against previous theories, cannot be regarded as able to deal with all the facts, and must be replaced by a theory in which the difference between what is experienced and what is not experienced by a given subject at a given moment is made simpler and more prominent than it can be in a theory which wholly denies the existence of specifically mental entities.

BERTRAND RUSSELL.

CAMBRIDGE, ENGLAND.

THE PRINCIPLES OF MECHANICS WITH NEWTON

FROM 1666 TO 1679.

NEWTON'S achievements with respect to the principles of mechanics have been considered by Mach.[1] I have tried to supplement this account by a thorough study of what is known or can be concluded about the development of Newton's ideas on the principles of mechanics. For this purpose it was necessary, above all, to make use of the manuscripts of Newton prior to the publication (1687) of the *Principia*. Many of these manuscripts have been carefully preserved in the library of Cambridge University, and these I have examined, thereby bringing to light a fact of importance, showing the occurrence of the conception of mass with Newton at an early date. Of the other manuscripts of Newton, the most important of those in the possession of the Royal Society of London and Trinity College, Cambridge, and some others, have already been published, and the new views suggested thereby—such as that of the important place which the determination of the attraction of a sphere of gravitating matter or an external point holds in the series of Newton's discoveries—require exposition and discussion, especially as they are not referred to by Mach.

[1] *Mechanics*, pp. 187-245. Dühring (*Kritische Geschichte der allgemeinen Principien der Mechanik*, 3d ed., Leipsic, 1887, pp. 172-211) gave an account of Newton's achievements, but by not examining Newton's conception of mass he neglected the discussion of the most important of these achievements—at least from the point of view of the principles of mechanics.

Indeed, the more we learn of Newton's work prior to 1687 and of the work of Newton's contemporaries, the more do we seem to be forced to the opinion that the importance of Newton's work was mainly due to the great mathematical advance which he made by the invention of his "method of fluxions" and his application of it to the problems of dynamical astronomy. It is not, as I think I have shown,[2] by a feat of the imagination that Newton is distinguished from his contemporaries; and the conception of mass and the principle of reaction, though never so clearly stated before Newton, had been accepted and used by many before Newton. Newton, owing to his mathematical ability of precisely formulating the principles he used in his mathematical physics, gave these principles a fairly clear expression,—and an expression in which many people, even at the present day, are acquainted with them to the exclusion of all other views, all historical knowledge, and all criticism. This one-sidedness must be regarded as most unfortunate, especially when certain defects in the Newtonian formulations are so plain to modern eyes.

Historical investigations bring before us the efforts of Newton's predecessors and contemporaries, and give us a truer idea of what Newton accomplished. Also these investigations sometimes serve the purpose of establishing the independence of two discoverers. In the present case we shall see most clearly that Newton's first investigations on circular orbits could not have been influenced by the results which, no doubt, Huygens had already obtained.

The present paper deals with Newton's work on mechanics from 1666 to 1679.

I.

The attempt to represent the movements of the heavenly bodies by a simple mathematical process was, appar-

[2] *Monist*, July, 1913.

ently, first made by Eudoxus of Cnidus[3] in Asia Minor (408-355 B. C.). According to him, the earth was the center of the universe, and round it rotated with uniform velocity spheres carrying the stars, sun, and so on. The irregularities in the motions of the sun and moon which were soon found to exist were explained by Hipparchus of Rhodes (about 190-120 B.C.) by supposing that, though the sun and moon moved uniformly in their orbits, yet the center of their orbits was not the center of the earth. The great successor of Hipparchus was Claudius Ptolemy of Alexandria, who carried on the work of astronomical observation from about 127 to 150 A. D. He worked out an extremely elaborate scheme by which he represented the motions of the planets with considerable accuracy by means of a complex apparatus of epicycles.

For more than 1300 years the Ptolemaic system remained without serious challenge, and it was Nicolas Copernicus[4] (1473-1543) who observed that the celestial motions could be described far more simply if the sun were supposed to be the fixed center of the planetary system and the earth and the other planets to revolve round it. This great discovery was only communicated orally by Copernicus to his disciples, on account of possible theological difficulties, but shortly before his death his great work *De revolutionibus orbium caelestium* was published by Rheticus (1543) with a dedication by Copernicus to the pope, and with the remark that it is not necessary that astronomical hypotheses be either true or probable, but that they accomplish their object if they reconcile calculation with observation. The earth having been abandoned as the center of the universe, a further sacrifice had to be made: the principle of uniform motion in a circle had

[3] Cf. E. W. Maunder, *The Science of the Stars,* London and Edinburgh, 1912, pp. 20-31.

[4] Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton,* Edinburgh, 1855, Vol. I, pp. 253-258.

also to be given up. This came as a result of the more refined observations of the Dane Tycho Brahe[5] (1546-1601).

The observations of Tycho Brahe enabled his friend and pupil Johann Kepler[6] (1571-1630) to subject the planetary motions to a far more searching examination than had yet been attempted. Kepler first endeavored to represent the planetary orbits by the hypothesis of a uniform motion in circular orbits; but, in examining the orbit of Mars, he found the deviations from a circle too great to be owing to errors of observation. He therefore compared the observations with various other curves, and was led to the discovery that Mars revolves round the sun in an elliptical orbit in one of the foci of which the sun is placed. By means of the same observations, he found that the radius vector drawn from the sun to Mars describes equal areas in equal times. These two discoveries were extended to all the other planets of the system and were published at Prague in 1609 in his *Nova astronomia seu physica caelestia tradita commentariis de motibus stellae Martis.* In 1619 he published at Linz his *Harmonia mundi,* containing his third great discovery that the periodic times of any two planets in the system are to one another as the cubes of their distances from the sun.

Kepler also made speculations on the subject of gravitation, and these and other theories of gravitation—for example, of Descartes, Bouillaud, Borelli, Huygens, and Hooke—before Newton, are described by Rosenberger in the book cited below.[7]

II.

The impressive nature of many of the Newtonian discoveries in mechanics tends to hide what is, perhaps, the most important aspect of Newton's work. Newton put into

[5] *Ibid.,* pp. 258-263.
[6] *Ibid.,* pp. 263-270.
[7] Pp. 135-157. Cf. Brewster, *op. cit.,* pp. 282-288.

our hands the key which unlocks many of the secrets of astronomy, such as the motions and attractions of sun and planets, and most people—even among scientific people—allow their admiration of Newton's results in celestial mechanics completely to hide what ought to be their admiration of what Newton did for the principles of dynamics. As Dühring[8] says: "The achievements of Newton in our domain [the principles of mechanics] are too often only appreciated under the influence of the applications of mechanics to the planetary system, and thus, especially by the English, relatively overestimated. By this, not only has an injustice been done to Galileo and Huygens, but that popular kind of judgment has been adopted in which the measure of appreciation is gauged, not by the consideration of the advances in point of principle but by the completed fact of a notable application and the astonishment at gigantic dimensions and discoveries so surprising in their spontaneity (*Unmotivirtheit*)." Lagrange,[9] comparing Galileo's telescopic discoveries with his contributions to mechanics, says that his mechanical investigations "did not bring him, in his life-time, as much celebrity as those discoveries which he made about the system of the world, but they are to-day the most enduring and real part of the glory of this great man. The discoveries of Jupiter's satellites, of the phases of the moon, of the sun-spots, and so on, only needed telescopes and assiduity; but extraordinary genius was needed to disentangle the laws of nature from phenomena which are always going on under our eyes, but of which the explanation had always eluded the search of philosophers."[10] We are tempted to remark that, in Newton's case, only mathematical talent and the method of fluxions (or the differential and integral cal-

[8] *Op. cit.*, p. 172.

[9] *Méchanique analitique*, Paris, 1788, p. 159; cf. *Œuvres de Lagrange*, Vol. XI, pp. 237-238.

[10] On Galileo's work, cf. also Brewster, *op. cit.*, pp. 270-282.

culus) were needed to work out the paths of the planets under their mutual attractions; but extraordinary genius was needed to discover the fundamental principles of mechanics which were necessary and sufficient in order that the application of mathematics might completely solve the problems of mechanics. However, we must remember that it was Newton himself who discovered the method of fluxions; while, on the other hand, no reasonable person can seriously maintain that Newton's formulation of the principles was wholly clear and cannot be improved upon. It is more correct to say that he succeeded in giving what is, in essentials, a *sufficient* foundation for mechanics: the foundation is not wholly *necessary*, in view of the facts that there is much tautology and at least one entity—mass—is "defined" by an apparent definition which really involves a vicious circle.

We are going to try to ascertain the growth of Newton's ideas on the principles of mechanics. This is made difficult by three circumstances: (1) In all historical or critical accounts known to me of Newton's contributions to the principles, only Newton's *Principia* of 1687, and not his earlier manuscripts and other sources of information, have been analyzed; (2) in those publications where some account is given of Newton's earlier manuscripts, attention has been paid, almost to the exclusion of everything else, to the growth of his methods for dealing with astronomical problems; (3) the interest of both the contemporaries of Newton and their successors has been fixed, for the reasons stated above, on Newton's discoveries in celestial mechanics, and consequently we find—as in all branches of science until, comparatively speaking, recent years—that fundamental principles, especially when the deductions from them impress us by their grandeur, are often accepted uncritically. If science is compared to a tree—which, we must remember, grows both upwards and down-

wards—we may say that the average man of science does not care to busy himself with the roots when such a fine prospect can be attained by climbing. The life of a tree is in its roots; and science, if its roots are not cultivated, becomes worse than dead science—it becomes living pedantry.

I have made a thorough study of all the books which appeared to me to cast any light on the development of Newton's ideas on the principles of mechanics before 1687, and also of those manuscripts which Newton wrote before 1687 on mechanics, and which have either been printed or are preserved in the library of the University of Cambridge.

III.

I will first of all give a list of authorities consulted.

Stephen Peter Rigaud: *Historical Essay on the First Publication of Sir Isaac Newton's Principia,* Oxford, 1838.

J. Edleston: *Correspondence of Sir Isaac Newton and Professor Cotes, including Letters of Other Eminent Men, now first published from the originals in the Library of Trinity College, Cambridge; together with an Appendix containing other unpublished Letters and Papers by Newton; with Notes, Synoptical View of the Philosopher's Life, and a Variety of Details illustrative of his History,* London and Cambridge, 1850.

Sir David Brewster: *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton,* 2 vols., Edinburgh, 1855. A second edition—apparently unaltered, even as to the mistakes—was published at Edinburgh in 1860.

W. W. Rouse Ball: *An Essay on Newton's "Principia,"* London and New York, 1893.

Ferdinand Rosenberger: *Isaac Newton und seine physikalischen Principien. Ein Hauptstück aus der Entwickelungsgeschichte der modernen Physik,* Leipsic, 1895.

In addition to these, there is the Portsmouth Collection of scientific papers belonging to Newton, which is now in the possession of the University of Cambridge, and has been examined and arranged in the University library. A descriptive catalogue of it was published at Cambridge in 1888 under the title: *A Catalogue of the Portmouth Collection of Books and Papers written by or belonging to Sir Isaac Newton, the Scientific Portion of which has been presented by the Earl of Portsmouth to the University of Cambridge.* This catalogue was drawn up by the syndicate appointed on November 6, 1872, and the Preface is signed by H. R. Luard, G. G. Stokes, J. C. Adams, and G. D. Liveing.

An indication of the nature of the extant manuscripts and correspondence of Newton on scientific subjects is given in the above-cited book by Rouse Ball.[11] Both Rigaud and Brewster printed part of Newton's correspondence, but Rouse Ball has printed the most complete sets of correspondence between Hooke and Newton and between Halley and Newton. For these letters, then, I shall refer to Rouse Ball's book alone.

Fifty-nine letters from and to Newton were published by Rigaud in the second volume of *Correspondence of Scientific Men of the Seventeenth Century, including Letters of Barrow, Flamsteed, Wallis, and Newton, printed from the Originals in the Collection of the Right Honourable the Earl of Macclesfield,*[12] and a table of contents and in-

[11] *Op. cit.*, pp. 2-5. Here I will remark that the above books will always, in what follows, be referred to by the names of their respective authors followed by "*op. cit.*" The reference "*Portsmouth Catalogue*" is to the catalogue just mentioned.

[12] Two volumes, Oxford, 1841. The book was posthumous and was edited by Rigaud's son, Stephen Jordan Rigaud. The letters in question are on pp. 281-437 of Vol. II, and begin with the date 1669. These letters do not seem to contain anything of interest in connection with our present subject, which has not passed over into Brewster. Pp. 242-254 are interesting in connection with the respective merits of Gregory's and Newton's telescopes. The first volume seems to contain little of interest.

dex were added by A. De Morgan[13] in 1862.[14] Neither name nor date appeared on the supplement itself.

We must also mention A. De Morgan's[15] review of Brewster's *Memoirs*.[16] De Morgan clearly showed that Brewster had succumbed to hero-worship, and had consequently been unjust to Leibniz and Flamsteed. It cannot be too strongly emphasized that De Morgan, by his deep historical researches, high standard of conduct, and eminent sanity of judgment, has made contributions of the utmost value to our knowledge and estimation of the character and religious opinions of Newton.

IV.

For the biography of Newton (1642-1727) the chief authorities are De Morgan, to whose essays we here refer once for all, Edleston, and Brewster. To Edleston's book is prefixed an admirable "Synoptical View of Newton's Life." We shall here be concerned almost wholly with his work up to and including the publication of the *Principia* in 1687. From a scientific point of view Newton's further life is of far less interest.

According to Brewster, the date of Newton's quitting Cambridge is written by his own hand in his commonplace book as 1665; and thus Brewster concluded that he left Cambridge "sometime before the 8th of August, 1665,[17] when the college was 'dismissed' on account of the plague, and it was therefore in the autumn of that year, and not

[13] According to p. 414 of the *Memoir of Augustus De Morgan*, by his wife Sophia Elizabeth De Morgan (London, 1882).

[14] Rouse Ball, *op. cit.*, p. 4. Here, too, is some information about the Macclesfield Collection.

[15] The review is unsigned, but. cf. (Mrs.) S. E. De Morgan's *Memoir of Augustus De Morgan*, p. 261.

[16] *The North British Review*, Vol. XXXIII, 1855, pp. 307-338.

[17] See also Brewster, *op. cit.*, Vol. I, note on p. 30.

in that of 1666 [as Pemberton said], that the apple is said to have fallen from the tree at Woolsthorpe, and suggested to Newton the idea of gravity." On the other hand, Newton himself said[18] that in the beginning of the year 1666 he procured a glass prism "to try therewith the phenomena of colors"; and, after further particulars, added:[19] "Amidst these thoughts I was forced from Cambridge by the intervening plague."

After Newton's return to Cambridge on the disappearance of the plague, he was elected Minor Fellow on the first of October, 1667. He took his degree of Master of Arts in 1668. In 1669 Newton succeeded Isaac Barrow in the Lucasian professorship of mathematics.

With Rouse Ball,[20] we consider the origin and history of the *Principia* previous to its compilation and publication (1685-1687) under three heads, which deal

a. with Newton's investigations in 1666;

b. with his investigations in 1679;

c. with his investigations in 1684, of which the chief results are embodied in the *De motu* of 1685.

Newton alluded to the subject of his early investigations in a letter to Halley of June 20, 1686:

"That in one of my papers writ (I cannot say in what year, but I am sure some time before I had any correspondence with Mr. Oldenburg, and that's) above fifteen years ago, the proportion of the forces of the planets from the sun, reciprocally duplicate of their distances from him, is expressed, and the proportion of our gravity to the moon's *conatus recedendi a centro terrae* is calculated, though not accurately enough."[21]

On July 14, 1686, Newton wrote to Halley:[22]

".... but for the duplicate proportion I can affirm

[18] *Ibid.*, p. 380. [19] *Phil. Trans.*, Vol. VI, p. 3075.
[20] *Op. cit.*, p. 2. [21] *Ibid.*, p. 157. [22] *Ibid.*, p. 165.

that I gathered it from Kepler's theorem about twenty years ago."

In a memorandum written, perhaps, about 1714,[23] Newton wrote that he had said "in the Introduction to the book of Principles":

"I found the Method [of fluxions] by degrees in the years 1665 and 1666. In the beginning of the year 1665 I found the method of approximating Series and the Rule for reducing any dignity of any Binomial into such a series. The same year in May I found the method of tangents of Gregory and Slusius, and in November had the direct method of fluxions, and the next year in January had the theory of colors, and in May following I had entrance into the inverse method of fluxions. And the same year I began[24] to think of gravity extending to the orb of the moon, and having found out how to estimate the force with which [a] globe revolving within a sphere presses the surface of the sphere, from Kepler's rule of the periodical times of the planets being in a sesquialterate proportion of their distances from the centers of their orbs I deduced that the forces which keep the planets in their orbs must [be] reciprocally as the squares of their distances from the centers about which they revolve: and thereby compared the

[23] *Ibid.*, pp. 6-7. This manuscript is in Section I, Division XI, Number 41, of the Portsmouth Collection, among unarranged fragments of papers relating to the dispute with Leibniz about the invention of the "Method of Fluxions." After the quotation of this note in the *Portsmouth Catalogue* is the remark (p. xix): "Newton appears to have made one or two mistakes of date, and, probably for this reason, has drawn his pen through the entire passage." On the other side of the page of manuscript is a reference to Leibniz's death as having taken place. Leibniz died in 1716, so that Rouse Ball's above conjectured date would appear to be two years too early.

[24] "The question of gravitation," says Rouse Ball (*op. cit.*, p. 6), "was one of the problems of the time, hence it was natural that he should consider it. It is, however, probable that at this period his inquiries on the subject were of but a slight character, and would have passed almost unnoticed had they not proved the earliest steps to his later discoveries. His conclusions were not published, nor, as far as we know, are they contained in any manuscript now extant." The contributions of Kepler, Gilbert, Bouillaud, Borelli, and Hooke to the theory of gravitation before Newton are dealt with by Brewster, *op. cit.*, Vol. I, pp. 268-269, 282-288, and very much more fully by Rosenberger, *op. cit.*, pp. 135-157. Newton mentioned Borelli and Bullialdus (Bouillaud) in a letter to Halley (Rouse Ball, *op. cit.*, pp. 159-160).

force requisite to keep the moon in her orb with the force of gravity at the surface of the earth, and found them answer pretty nearly. All this was in the two plague years of 1665 and 1666, for in those days I was in the prime of my age for invention, and minded mathematics and philosophy more than at any time since. What Mr. Huygens has published since about centrifugal forces I suppose he had before me. At length in the winter between the years 1676 and 1677 [probably this should be 1679 and 1680] I found the proposition that by a centrifugal force reciprocally as the square of the distance a planet must revolve in an ellipse about the center of the force placed in the lower umbilicus of the ellipse and with a radius drawn to that center describe areas proportional to the times. And in the winter between the years 1683 and 1684 [this should be the winter between 1684 and 1685] this proposition with the demonstration was entered in the Register Book of the Royal Society.

"By this method [of fluxions] I invented the demonstration of Kepler's proposition in the year 1679, and almost all the rest of the more difficult propositions of the book of Principles in the years 1684, 1685, and part of the year 1686."

This account is not quite consistent with the more generally known and credited accounts of Whiston and Pemberton,[25] in which Newton is said to have thrown aside his calculation because of the discrepancy with observation—for he supposed a degree of latitude on the surface of the earth to contain sixty miles—and only to have taken them up again when the more exact measurements of Picard (1670) showed that the discrepancy was not very great after all.

Whiston and Pemberton's account was partly the basis

[25] Rouse Ball, *op. cit.*, pp. 8-11. It is more convenient to refer to this reproduction of Whiston and Pemberton's accounts in the *Memoirs* (1749) and *View of Sir Isaac Newton's Philosophy* (1728) respectively.

of that given in Sir David Brewster's *Memoirs of Newton*:[26] "It was doubtless in the same remarkable year 1666, or perhaps in the autumn of 1665, that Newton's mind was first directed to the subject of gravity. He appears to have left Cambridge some time before the 8th of August 1665, when the college was dismissed on account of the plague, and it was therefore in the autumn of that year, and not in that of 1666, that the apple is said to have fallen from the tree at Woolsthorpe, and suggested to Newton the idea of gravity. When sitting alone in the garden and speculating on the power of gravity, it occurred to him that, as the same power by which the apple fell to the ground was not sensibly diminished at the greatest distance from the center of the earth to which we can reach, neither at the summits of the loftiest spires nor on the tops of the highest mountains, it might extend to the moon and retain her in her orbit in the same manner as it bends into a curve a stone or a cannon ball, when projected in a straight line from the surface of the earth. If the moon was thus kept in her orbit by gravitation to the earth, or, in other words, its attraction, it was equally probable, he thought, that the planets were kept in their orbits by gravitating towards the sun. Kepler had discovered the great law of the planetary motions, that the squares of their periodic times were as the cubes of their distances from the sun, and hence Newton drew the important conclusion that the force of gravity or attraction by which the planets were retained in their orbits varied as the square at the earth's surface. He was therefore led to compare it with the force exhibited in the actual motion of the moon, in a circular orbit; but, having assumed that the distance of the moon from the earth was equal to sixty of the earth's semidiameters, he found that the force by which the moon

[26] The passage referred to occurs in Vol. I, pp. 25-27 (2d ed., Vol. I, pp. 23-24); cf. pp. 290-291 (2d ed., Vol. I, pp. 253-254).

was drawn from its rectilineal path in a second of time was only 13.9 feet, whereas at the surface of the earth it was 16.1 in a second. This great discrepancy between his theory and what he then considered to be the fact, induced him to abandon the subject and pursue other studies with which he had been previously occupied."

To the last sentence is attached a note on the story of the apple, to which we will shortly refer below.

Pemberton mentioned 1666 as the year in which the first thoughts that gave rise to the *Principia* occurred to Newton. This date was adopted by Rigaud, denied, as we have seen, by Brewster, and accepted, apparently on the grounds of the above manuscript account of Newton's, by Rouse Ball. Rigaud[27] remarks: "From Dr. Hodge's *Loimologia,* we learn that the plague began first in Westminster, at the end of 1664; that in London it was most violent in the hotter months of 1665, and had so far abated in the following winter that the inhabitants returned to their homes in December. The Royal Society did not indeed resume their regular meetings till March, 1666; but the disease had then subsided, and some writers have therefore referred Newton's speculation to 1665. Pemberton, however, is certainly right in assigning his retirement into Lincolnshire to the following year. In the sixth volume of the *Philosophical Transactions* there is a paper [already referred to] in which he says. . . .that he was forced from Cambridge by the plague [in 1666]. Further, Edleston[28] gives 1666 as the year in which the first idea of gravitation occurred to Newton.

I have devoted some space to what may appear the unimportant question as to whether Newton's first speculations on gravity took place in 1665 or 1666. The reason why the question is not unimportant arises from the fact that Newton had found, in essentials, his method of fluxions

[27] *Op. cit.,* note on p. 1. [28] *Op. cit.,* p. xxi.

in 1665 and the beginning of 1666.[29] When we reflect that it was this method that formed the indispensable instrument for the discovery of the motion of a particle round a center of force, we see the importance of this. Newton was accustomed to the handling of problems involving infinitesimal or fluxional considerations; such considerations enabled him, since he stood at the new point of view in mechanics reached by Galileo, to calculate at once the relation afterwards published by Huygens between the force to the center of a circular orbit, the uniform velocity of a body describing this orbit and the radius of the orbit. Such considerations also showed—and this is a very important point—that there was now no great difficulty in extending calculations to orbs other than circular. Indeed, as Newton said in the postscript to his letter of June 20, 1686, to Halley, any mathematician could have concluded, from Huygens's discovery of the law of force in circular orbits, the manner of finding such laws even when the orbits were not circular.[30]

That Newton *did* take the inaccurate estimate is very probable.[31] After the feat of imagination involved in supposing that the power of gravity extends as high as the moon,[32] he seems to have started from Galileo's law of inertia, upon which he always seems—perhaps because of these questions—to have laid a great and logically unnecessary stress, thus showing that it may help our minds to have the proposition B emphasized even when we have already admitted the proposition A and we know that A implies B. As Whiston[33] says: "An inclination came into

[29] Brewster, *op. cit.*, Vol. I, p. 25. [30] Rouse Ball, *op. cit.*, p. 160.

[31] Cf. *ibid.*, pp. 15-16.

[32] Cf. Mach, *op. cit.*, pp. 189-190, 513-514; Rouse Ball, *op. cit.*, pp. 9, 11. With regard to the origin of these speculations, the story of the apple, which Mach (*op. cit.*, p. 510) mentions with scorn, seems to have some foundation (cf. Rouse Ball, *op. cit.*, pp. 11-12). Cf. on this point Rosenberger, *op. cit.*, pp. 119-120; Rigaud, *op. cit.*, pp. 1-2; Brewster, *op. cit.*, Vol. I, note on p. 27. The story was first circulated by Voltaire.

[33] Rouse Ball, *op. cit.*, p. 8.

Sir Isaac's mind to try whether the same power did not keep the moon in her orbit, notwithstanding her projectile velocity and which he knew always tended to go along a straight line, the tangent of that orbit — which makes stones and all heavy bodies with us fall downward, and which we call gravity." Similarly Pemberton says:[34] "As he sat alone in a garden, he fell into a speculation on the power of gravity: that as this power is not found sensibly diminished at the remotest distance from the center of the earth to which we can rise, neither at the tops of the loftiest buildings, nor even on the summits of the highest mountains; it appeared to him reasonable to conclude that this power must extend much farther than was usually thought; why not as high as the moon, said he to himself, and, if so, her motion must be influenced by it; perhaps she is retained in her orbit thereby. However, though the power of gravity is not sensibly weakened in the little change of distance at which we can place ourselves from the center of the earth, yet it is very possible that, so high as the moon, this power may differ much in strength from what it is here. To make an estimate what might be the degree of this diminution, he considered with himself that if the moon be retained in her orbit by the force of gravity, no doubt the primary planets are carried round the sun by the like power."

As a first approximation, Newton supposed the moon to be a particle revolving in a circular orbit about the earth as center. In the investigation which followed, Newton seems to have proved independently Huygens's proposition about the centripetal acceleration in a central orbit, that[35]

$$\varphi = v^2/r.$$

It is not unlikely, as Rouse Ball[36] remarks, that New-

[34] *Ibid.*, pp. 9-10.

[35] Mach, *op. cit.*, p. 160; *Ostwald's Klassiker*, No. 138, pp. 41-46, 74-76.

[36] *Op. cit.*, p. 13.

ton's proof of this relation was that referred to in his letter to Halley of July 14, 1686, when mentioning the form in which he proposed to get the scholium to the fourth proposition of the first book of the *Principia*: "In turning over some old papers, I met with another demonstration of that proposition, which I have added at the end of this scholium."[37] This proof is, as will be seen, based on infinitesimal principles:

"In any circle suppose a polygon to be inscribed of any number of sides. And if a body, moved with a given velocity along the sides of the polygon, is reflected from the circle at the several angular points; the force with which at every reflection it strikes the circle will be as its velocity: and therefore the sum of the forces, in a given time, will be as the velocity and the number of reflections conjointly; that is (if the species of the polygon be given), as the length described in that given time, and increased or diminished in the ratio of the same length to the radius of the circle; that is, as the square of that length applied to the radius, and therefore if the polygon, by having its sides diminished *in infinitum,* coincides with the circle, as the square of the arc described in a given time applied to the radius. This is the centrifugal force with which the body impels the circle, and to which the contrary force, wherewith the circle continually repels the body towards the center, is equal."

I cannot see[38] any grounds for supposing that Newton, in these early investigations, drew the conclusion from Kepler's law of areas that this law implies a central acceleration and a uniform speed if the orbit were a circle. Indeed the law of areas was avowedly demonstrated by Newton at a much later date. It is not necessary to suppose that Newton had verified exactly the very natural conjec-

[37] *Ibid.*, p. 165.

[38] Cf. J. Cox, *Mechanics,* Cambridge, 1904 and 1909, pp. 90-91. On Newton's early investigations, see also pp. 85-86.

ture that, if a body describes a circle uniformly, the deflective force is to the center of the circle. We must notice here that Kepler's laws were stated for the sun and the planets. That Newton considered the laws to apply also to the case of the earth and moon may perhaps be considered to be an indication that Newton had already extended the conception of gravitation to all matter, conformably to the third rule of his *regulae philosophandi*:

"....If it universally appears, by experiments and astronomical observations, that all bodies about the earth gravitate towards the earth, and gravitate in proportion to the quantity of matter which they severally contain; that the moon likewise, according to the quantity of its matter, gravitates towards the earth; that, on the other hand, our sea gravitates towards the moon; and all the planets mutually one towards another; and the comets in like manner towards the sun; we must, in consequence of this rule, universally allow that all bodies whatsoever are endowed with a principle of mutual gravitation. For the argument from the appearances concludes with more force for the universal gravitation of all bodies than for their impenetrability; of which, among those in the celestial regions, we have no experiments, nor any manner of observation."

Now, Kepler's third law (1619) is that the cubes of the major axes of the elliptical paths of the planets round the sun vary as the squares of the periodic times. Assuming that the earth bears much the same relation to the moon as the sun does to a planet, and that the orbit of the moon is circular, Kepler's third law states that

$$r^3/T^2 = k,$$

where r is the radius of the orbit, T the periodic time, v so that

$$v = 2\pi r/T,$$

and k is a constant. Substituting for v and then T in the above equation for φ, we get

$$\varphi = 4\pi^2/kr^2,$$

so that the force varies inversely as the square of the distance.

Newton[39] then calculated the space x through which the moon (considered as a particle) was drawn towards the earth in one second. He knew the space x' through which a particle near the surface of the earth was drawn by gravity in one second; it is about 16.1 feet. If his calculation showed that the ratio of x to x' was inversely as the ratio of the square of the distance of the moon from the earth's center, it would follow that the force which kept the moon in her (circular) orbit was the same as gravity. Newton made the numerical calculations, "though," as he says, "not accurately enough." Most likely they were made in the same way as that given in the fourth proposition of the third book of the *Principia*. This was as follows: The mean distance of the moon may be taken as $60a$, where a is the radius of the earth; the time of the moon is 39,343 minutes. Hence, in one minute the moon periodically describes an arc $2\pi.60a/39343$, and, therefore, is drawn towards the earth through a distance equal to the versine of this arc. If a be taken as 4000 miles, this distance is about sixteen English feet, and it would follow that in one second the moon would be drawn through a distance x equal to $16/(60)^2$ feet; thus the moon and a particle near the earth would be drawn in one second through spaces very nearly inversely proportional to the squares of their distances from the earth's center; and the approximation is so close that we might reasonably infer that the force which keeps the moon in her orbit is the same as gravity. This verification requires that the value of a,

[39] Cf. Rouse Ball, *op. cit.*, pp. 13-15; Cox, *op. cit.*, pp. 92-93.

the earth's radius, shall be known approximately. Now, Pemberton and Whiston agree that Newton assumed that a degree of latitude on the earth contains 60 miles (whereas, in fact, it contains about 69½ miles). This is equivalent to saying that Newton supposed that the radius of the earth was $10800/\pi$ miles, that is to say, rather more than 3,400 miles (whereas, in fact, it contains about 4000 miles). Hence his value of a was about one-eighth too small, and thus his calculations seemed to show that in one second the moon fell through only seven-eighths of the distance through which gravity alone would have pulled it. The calculation with his data gives $x =$ 13.9 feet.

This discrepancy does not appear, judging by Newton's own account given above, to have shaken his faith in the view that gravity, diminishing inversely as the square of the distance, acted on the moon, but led him to infer that some other force acted as well; and Whiston adds that Newton believed the other cause to be "Cartesius's vortices," while Pemberton states that Newton's "computation did not answer expectation; whence he concluded that some other cause must at least join with the power of gravity on the moon." But yet the view that Newton was quite disappointed by his calculation used to be generally held.

As regards the calculation of the distance fallen through by the moon in a second of time, Newton's object was to determine whether the moon, being deflected from the rectilinear direction of its motion, was drawn down towards the earth by a quantity which, according to the law which he assumed, would be consistent with the space through which heavy bodies in the same time have been found to fall at the earth's surface. The moon's distance being taken in semi-diameters of our globe, the absolute space through which it moved in its orbit during a given

time was to be deduced from the magnitude of the earth. Now Newton took the common measure of sixty miles for a degree of latitude, which had been used by the old geographers and seamen. This was considerably too small, and consequently the distance by which the moon would under such circumstances have been drawn from the tangent of its orbit, came out less than the truth. Possibly the quantity which formed the foundation of his calculation had been the more impressed on his mind from its agreement with the result of the observations which Edward Wright had published in 1610. Wright was a Cambridge man—a fellow of Caius College—which may have made his work more familiar to the members of the University.[40] With regard to the measurement published by Norwood in 1636, Voltaire[41] remarked that the civil wars "had buried it in oblivion"; but in this respect Voltaire was certainly mistaken, as Rigaud[42] showed from the number of editions through which Norwood's work passed, and from contemporary evidence. The question as to how and when Newton became acquainted with Picard's measurement of 1671, and other questions, were very fully discussed by Rigaud.[43] However, the modern idea, first advocated by Adams, and based upon Newton's own manuscript note among the Portmouth papers, is that Newton did not lay great stress upon the close accuracy of his 1666 calcu-

[40] Rigaud, *op. cit.*, p. 3. On the measurements of Snell and Norwood, see Rouse Ball, *op. cit.*, pp. 15-16. It may be mentioned that Newton possessed a copy of Robert Wright's (formerly of Jesus College, Cambridge) book *Viaticum Nautarun, or the Sailor's Vade Mecum* (see *Portsmouth Catalogue*, p. 56). I have hitherto been unable to find a copy of this work; the one in the Portsmouth Collection has been returned to Lord Portsmouth.

[41] See below.

[42] *Op. ct.*, pp. 4-5.

....[43] *Op. cit.*, pp. 6-12; cf. Brewster, *op. cit.*, Vol. I, pp. 290-291; Rouse Ball, *op. cit.*, pp. 22-23; *Principia*, Props. iv and xix, of Book III. Hooke, in his letter to Newton referred to below, of Nov. 24, 1679, alluded to Picard's geodetical measurements, and probably this led Newton to use Picard's estimate in the revision of his calculation. It should be mentioned that Snell's fairly accurate measure was mentioned in a book by *Varenius*, of which Newton brought out an edition in 1672 (Rouse Ball, *op. cit.*, p. 16).

lation, nor, consequently, upon Picard's new measurement. The whole question of the determination of forces and orbits seems to have appeared to him much more of merely a rough approximation than it actually was until, in 1685, he discovered his theorem on the attraction of spherical bodies. This will be considered more closely in the next section but one; and we will close the present section by giving a translation of Voltaire's account, in *Elémens de la Philosophie de Neuton,*[44] of Newton's early work on the theory of gravitation. This account is of great historical interest, as it was chiefly through Voltaire that Newtonianism became popular in France.

"One day in the year 1666, Newton, having retired to the country and seeing the fruits of a tree fall, fell, according to what his niece, Mrs. Conduitt, has told me, into a deep meditation about the cause that thus attracts all bodies in a line which, if produced, would pass nearly through the center of the earth. What, he asked himself, is the force which cannot arise from these imaginary vortices that have been proved to be false?[45] It acts on all bodies in proportion to their masses and not to their surfaces; it would act on the fruit which has just fallen from this tree if the tree were raised 3000 fathoms (*toises*)[46] or even 10,000 fathoms. If that is so, this force must act towards the center of the earth in the place where the moon is: if this is so, this power —whatever it may be—may, consequently, be the same as that which makes the planets tend towards the sun and as that which makes the satellites of Jupiter gravitate to Jupiter. Now it is demonstrated by all the inductions deduced from Kepler's laws that all these secondary planets

[44] First published in 1738. I quote from the new edition published at London in 1741, pp. 289-291.

[45] Voltaire, in fact, "proved" at the very beginning of the account of Newton's theory of gravitation that the Cartesian vortices and plenum are impossible.

[46] A *toise* is 6.39459 feet.

gravitate the more towards the center of their orbits as they are nearer and the less so as they are farther off, that is to say, reciprocally as the squares of their distances.

"A body placed in the position of the moon which revolves around the earth and a body placed near the earth must, then, both fall towards the earth exactly according to this law. Thus, to be assured if it is the same cause which retains the planets in their orbits and which makes heavy bodies fall to the earth, only measurements are necessary; we have only to examine what space is described by a heavy body falling to the earth in a given time and what space would be described, in a given time, by a body placed in the region of the moon. The moon itself is this body, and it may be considered as falling from its highest point of the meridian....

"It was thus that Newton reasoned; but he used, for the measurement of the earth, the faulty estimate of sailors, who counted sixty English miles for a degree of latitude, whereas it should have been seventy miles.

"There was, indeed, a more correct measurement of the earth. Norwood, an English mathematician, had measured a degree of the meridian fairly exactly in 1636 and had found it to be about seventy miles. But Newton did not know of this measurement made thirty years before. The civil wars which had afflicted England, and which are as harmful to the sciences as to the state, had buried in oblivion the only correct measurement of the earth that there was; and the rough estimate of sailors was kept. By this calculation the moon was too close to the earth, and the proportions sought by Newton were not given exactly. He did not think that he might add anything to fit nature to his ideas; he wished to fit his ideas to nature. He abandoned, therefore, the beautiful discovery which analogy with the other stars made so probable and to which so little

was lacking for demonstration; and this rare quality of Newton's must give a great weight to his opinions.

"Finally, with the more exact measurements made in France, he found the demonstration of his theory. . . . Newton thus took up again the thread of his demonstration."

We must remember that this extremely naive and superficial account had—perhaps because of the enthusiasm with which it was written—an enormous influence on eighteenth century France. Indeed, its influence extended far beyond the boundaries of France; perhaps the conclusion—not wholly made legitimate, in this instance at least, by what appears really to have happened—as to Newton's sublime scientific restraint may not have been without influence on Cox's *Mechanics*.[47]

VI.

The first great mathematical advance of Newton's lay in the determination of the law of force for orbits which were not circular. The treatment of circular orbits is simple,[48] but in the more general case account has to be taken of a curvature which varies from point to point.

The conception of circle of curvature was introduced into geometry by Kepler in 1609,[49] and there seem to have been no other investigations on curvature published before 1665, when Newton applied his newly discovered fluxions to "the finding the radius of curvity of any curve." The remarks of Wallis,[50] which arose out of a controversy about the angle of contact of a circle with its tangent, are of later date than this, and were not published till 1685.

The normal to a given curve at a given point (P) will intersect with the normal at a neighboring point (Q) at

[47] Cambridge, 1904 and 1909.

[48] Cf. Mach, *Mechanics*, pp. 158-161.

[49] Moritz Cantor, *Vorlesungen über Geschichte der Mathematik*, Vol. II, 2d ed., Leipsic, 1900, p. 603.

[50] *Ibid.*, Vol. III, 2d ed., Leipsic, 1901, pp. 26-27; cf. Vol. II, p. 687.

some point (C′) on the concave side of the curve. As Q approaches P, C′ will—at least in the case of all the curves considered by Newton and by his successors until comparatively modern times—approach a limiting position C. The circle described with center C and radius CP will fit the curve more closely in the neighborhood of P than does any other circle. This circle is called "the circle of curvature at P." The "radius of curvature" (CP) is a measure of the curvature of the curve; the smaller the radius of curvature, the sharper is the turning of the curve. We find CP by finding the limit of C′P. Now

$$C'P/PQ = \sin PQC'/\sin PC'Q,$$

and PC′Q is equal to the angle between the tangents at P and Q. Further, as Q approaches P, the angle PQC′ approaches a right angle, and PC′Q ultimately becomes nearly equal to its sine and then vanishes. Hence, in the usual notation, we find for CP the value $ds/d\varphi$.

Notice that we have to imagine, when we are dealing with a body describing a non-circular orbit, that, in the infinitely small interval of time from t to $t + dt$, the body describes a small circular arc of length ds and radius r, where $r = ds/d\varphi$, $d\varphi$ being the small angle subtended by the arc ds at the center of the circle. In general, r will vary from point to point; if the orbit is such that $ds/d\varphi$ is the same as s/φ, so that r is the same however large the arc s may be, the orbit is circular. We see, then, that we have only to apply simple infinitesimal considerations to pass from circular orbits, considered by Huygens and Newton independently, to the general case.

It may be added that the "curvature" at a point is usually defined to be $d\varphi/ds$ or $1/r$; and that the radius of curvature may be expressed in terms of the rectangular coordinates by means of the well-known formulae $ds^2 = dx^2 + dy^2$, and $\tan\varphi = dy/dx$, so that

$$d\varphi = [(d^2y/dx^2)dx]/[1 + (dy/dx)^2].$$

Now, let v be the tangential velocity of the body at P and $v + dv$ that at Q, and notice that $v = ds/dt$. The resolved part of the velocity at Q in a direction parallel to the normal at P is $(v + dv)\sin(d\varphi)$ or, neglecting the infinitesimal of the second order, $v.d\varphi$. The normal acceleration, then, at P is $(v.d\varphi)/dt$, or

$$v(d\varphi/ds)(ds/dt) = v^2/r,$$

where r is the radius of curvature at P. This is a generalization of the theorem of Huygens and Newton.

Another way of obtaining the same result is to call f the central acceleration, and to notice that the tangential velocity at Q is the result of compounding the tangential velocity v at P and the velocity $f.dt$ perpendicular to it. Now

$$(f.dt)/v = \tan(d\varphi) = d\varphi,$$

and, remembering that the angle PC'Q is equal to $d\varphi$,

$$d\varphi = (v.dt)/r;$$

so

$$f = v^2/r.$$

VII.

We now meet the question, referred to in the preceding section, which has done much towards the changing of our point of view towards the long delay and perhaps the lack of interest of Newton in the pursuit of the theory of gravitation.

In a letter to Halley of June 20, 1686, Newton wrote:[51]

"....I never extended the duplicate proportion lower than to the superficies of the earth and, before a certain demonstration I found the last year, have suspected that it did not reach accurately enough down so low; and there-

[51] Rouse Ball, *op. cit.*, p. 157.

fore in the doctrine of projectiles I never used it nor considered the motions of the heavens;. . . ."

The theorem in question contains the discovery that a spherical mass attracts an external particle as if the whole mass were concentrated at the center. We must remember that every particle of the mass is supposed to attract, so that this result is as simple as it is beautiful. Newton's papers and correspondence of 1679 and 1685 show, according to Rouse Ball,[52] that at this time he did not know how to determine the attraction of a solid body, like the sun or earth, on an external particle; he did not think that the earth's attraction was directed exactly to its center; and it is probable that, previously to 1685, he considered that the attraction of a planet on its moon (or of the sun on a planet) could be regarded as directed to a fixed point, and varying as the inverse square of the distance from it, only when the two bodies were at a distance so great that their dimensions could be neglected compared with the distance between them.

The extension of the idea of gravitation to the smallest particles of bodies is not only natural, but even seems to be, speaking psychologically, inevitable. Further, Newton's calculations on the moon's orbit were only very rough, and he could hardly have been deterred from following up the new idea by the merely approximate character of the result. These two considerations, combined with the probable cause mentioned above for the cessation of Newton's investigations for thirteen years, seem to have induced the celebrated English astronomer John Couch Adams[53] to believe that Pemberton and Whiston were mistaken as to the insufficiency of the verification. Newton knew that the orbit was not actually circular, and that his numerical data were only approximate; hence he could have expected only a rough verification of the hypothesis,

[52] *Ibid.*, p. 11.

[53] Rouse Ball, *op. cit.*, pp. 16-17.

and, as he asserted that he found his results agree or "answer pretty nearly," Adams considered that these calculations were sufficient to convince Newton that it was gravity alone that retained the moon in its orbit, and further, he strongly suspected that Newton already believed that gravity was due to the fact that every particle of matter attracts every other particle, and that this attraction varies as the product of the masses and inversely as the square of the distance between them. We will return to this point further on.

VIII.

It is important to bear in mind the fact that Newton could not have made use of the researches of Huygens on centrifugal force. Newton's first speculations and calculations on gravitation began in 1666, while Huygens's theorems on centrifugal force were given[54] in 1673, in the fifth part of the *Horologium oscillatorium*— but without proof—and a fairly complete "Tractatus de vi centrifuga" was only published in Huygens's *Opuscula Postuma* of 1703.[55]

A reader of Mach's *Mechanics*[56] might conclude that Newton followed in the footsteps of Huygens; but in point of fact it was Galileo's work alone which was the starting point for Newton's early reflections on gravitation and the moon's orbit.

[54] Some theorems were communicated by Huygens to the London Royal Society in 1669 in the form of an anagram.

[55] A convenient annotated German translation of this tract is given in No. 138 of *Ostwald's Klassiker.*

[56] P. 188. Mach here says: "He who clearly understands the doctrine of Galileo and Huygens, must see that a curvilinear motion implies deflective acceleration. Hence, to explain the phenomena of planetary motion, an acceleration must be supposed constantly directly towards the concave side of the planetary orbits." Of course this is not a statement that Newton made use of Huygens's discoveries, but it might be understood as implying that he did so. Dühring (*op. cit.*, p. 173) wrongly stated that Newton's theory partly grew out of Huygens's theory of motions in a circle under a central force. The fact that the beginnings of Newton's investigations of centripetal forces

"It is not merely," says Brewster,[57] "from his astronomical discoveries, brilliant as they are, that Galileo claims a high place in the history of Newton's discoveries. His profound researches on mechanical science—his determination of the law of acceleration in falling bodies—and his researches respecting the existence and cohesion of solid bodies, the motion of projectiles, and the center of gravity of solids, have ranked him among the most distinguished of our mechanical philosophers. The great step, however, which he made in mechanics was the discovery of the general laws of motion uniformly accelerated, which may be regarded as the basis of the theory of universal gravitation." Indeed, it seems that nobody can seriously maintain that Galileo's mechanical researches did not exert a far more important influence on Newton's work than did his astronomical discoveries. Undoubtedly, descriptions of the sun, moon, and planets are more striking to an ordinary person than a description of the law followed by falling bodies near the surface of the earth; but there can be no comparison between the essential importance to science of these descriptions. And we shall see that the correct mechanical principles to be followed in the formulation of the problem of finding the path of a particle which moves under the influence of a central attraction was familiar, for example, to Wren, Hooke, and Halley. These men were stopped by mathematical difficulties; the ideas of the fluxional or infinitesimal calculus were necessary for the progress of mechanics. It was fortunate that Newton had become familiar with the help that the conception of motion may offer in the solu-

were prior to the publication of Huygens's work was emphasized by J. Cox in his *Mechanics* (p. 90), a text-book written on the historical lines laid down so splendidly by Mach, and thus combining teaching, history, and criticism in a welcome manner. Cox (*op. cit.*, pp. 88-89) also laid stress on Galileo's law of inertia, which was and is so important psychologically to any one attacking problems of celestial mechanics.

[57] *Op. cit.*, Vol. I, pp. 273-274.

tion of certain geometrical problems and had invented the method of fluxions at a very early date.

IX.

With regard to the progress that Newton made between 1666 and 1679 in his ideas on gravitation, we have clear indications from Newton's own letters that he was familiar with the fact that gravitation varied inversely as the square of the distance by 1673 at the latest. When Huygens published his *Horologium oscillatorium* in 1673, he presented a copy to Newton, and Newton, in his letter of thanks, said:[58] "I am glad that we are to expect another discourse on the *Vis centrifuga,* which speculation may prove of good use in natural philosophy and astronomy, as well as mechanics. Thus, for instance, if the reason why the same side of the moon is ever towards the earth be the greater *conatus* of the other side to recede from it, it will follow (upon supposition of the earth's motion about the sun) that the greatest distance of the sun from the earth is to the greatest distance of the moon from the earth not more than as 10,000 to 56, and therefore the parallax of the sun is not less than 56/10,000 of the parallax of the moon; because, were the sun's distance less in proportion to that of the moon, she would have a greater *conatus* from the sun than from the earth. I thought also some time that the moon's liberation might depend upon her *conatus* from the sun and earth compared together till I apprehended a better cause."

The rest of this letter, which, for the most part, is on the subject of colors, was printed in the *Philosophical Transactions* of July 21, 1673. From the above words, "it is evident," continues Newton in his letter to Halley,

[58] The copy of this letter to Huygens was given in a letter of Newton to Halley of July 27, 1686 (Rouse Ball, *op. cit.*, p. 166). Before Newton found the copy of this letter, he gave from memory, in his letter to Halley of June 20, 1686, a slightly different account which is referred to below.

"that I was at the time versed in the theory of the force arising from circular motion, and had an eye upon the forces of the planets, knowing how to compare them by the proportions of their periodical revolutions and distances from the center they move about: an instance of which you have here in the comparison of the forces of the moon arising from her menstrual motion about the earth and annual about the sun."

The "better cause" mentioned in the above letter to Huygens was communicated in 1675 to Nicolas Mercator who published it in the following year in his *Institutiones astronomicae*. Galileo had discovered and explained the diurnal libration, arising from the spectator not viewing the moon from the center of the earth, but it was reserved for Newton to explain the libration in longitude which Hevelius, its discoverer, had ascribed to the displacement of the center of the moon's orbit from the center of motion. Newton showed that it was occasioned by the inequalities of the moon's motion in an elliptic orbit round the earth, combined with the uniformity of her motion round her axis. In the same letter to Mercator, he showed that the libration in latitude arose from her axis of rotation being inclined 88° 17′ to the ecliptic.

Before Newton had found the copy of his letter of 1673 to Huygens, he wrote to Halley on June 20, 1686, that he "gave those rules in the end [of Huygens's book] a particular commendation for their usefulness in philosophy, and added out of my aforesaid paper [an early manuscript, probably of 1666] an instance of their usefulness, in comparing the forces of the moon from the earth, and earth from the sun, in determining a problem about the moon's phase, and putting a limit to the sun's parallax; which shows that I had then my eye upon comparing the forces of the planets arising from their circular

motion, and understood it."[59] In a postscript to this letter, Newton added: "It is more than I can affirm that the duplicate proportion was not expressed in that letter."[60]

However, in the letter of July 27, 1686, Newton acknowledged: "Now, though I do not find the duplicate proportion expressed in this letter (as I hoped I might), yet, if you compare this passage of it here transcribed with that hypothesis of mine, registered by Mr. Oldenburg in your books, you will see that I then understood it. For I there suppose that the descending spirit acts upon bodies here on the superficies of the earth with force proportional to the superficies of their parts; which cannot be, unless the diminution of its velocity in acting upon the first parts of any body it meets with be recompensed by the increase of its density arising from that retardation. Whether this be true is not material. It suffices that it was the hypothesis. Now, if this spirit descend from above with uniform velocity, its density, and consequently its force, will be reciprocally proportional to the square of its distance from the center. But if it descend with accelerated motion, its density will everywhere diminish as much as its velocity increases; and so its force (according to the hypothesis) will be the same as before, that is still reciprocally as the square of its distance from the center."[61]

The hypothesis referred to in this letter was contained in the discourse presented in manuscript dated the 7th of December, 1675, to the Royal Society, with the title: "A Theory of Light and Colours, containing partly an Hypothesis to explain the properties of light discoursed of by him in his former papers, partly the principal phenomena of the various colours exhibited by thin plates or bubbles, esteemed to be of a more difficult consideration, yet to depend also on the said properties of light."[62]

[59] Rouse Ball, *op. cit*, pp. 157-158. [60] *Ibid.*, p. 160. [61] *Ibid.*, pp. 166-167.

[62] This paper was read on Dec. 9, 1675 (Birch, *op. cit.*, Vol. III, pp. 247, 260), and registered in the January or February following.

It is curious to notice that not long before this date Collins informed James Gregory that Newton and Barrow had "begun to think mathematical speculations at least dry, if not somewhat barren."[63] The hypothesis,[64] together with the controversy with Hooke to which it gave rise, belongs more particularly to the subject of physical optics; but the subject of gravity was occasionally referred to. An ether was assumed, and its heterogeneity seemed to be required by "the electric and magnetic effluvia, and the gravitating principle.[65] Again, there occurred the paragraph:[66] "And as the earth, so perhaps may the sun imbibe this spirit copiously to conserve his shining and keep the planets from receding further from him; and they that will may also suppose that this spirit affords or carries thither the solary fuel and material principle of light. And that the vast ethereal spaces between us and the stars are for a sufficient repository for this food of the sun and planets. But this of the constitution of ethereal natures by the by."

Newton quoted this paragraph in the postscript of the letter written to Halley on June 20, 1686, with the remark: "In these and the foregoing words you have the common cause of gravity towards the earth, sun, and all the planets, and that by this cause the planets are kept in their orbs about the sun. And this is all the philosophy Mr. Hooke pretends I had from his letters some years after, the duplicate proportion only excepted. The preceding words contain the cause of the phenomena of gravity, as we find it on the surface of the earth, without any regard to the various distances from the center. For at first I designed to write of nothing more. Afterwards, as my manuscript

[63] Brewster, *op. cit.*, p. 127.

[64] The "Hypothesis" was reprinted by Brewster on pp. 390-409; and an extract from Birch's *History* (Vol. III, pp. 249-251) in Rigaud (*op. cit.*, Appendix No. xx, pp. 68-70).

[65] Brewster, *op. cit.*, p. 392. [66] *Ibid.*, p. 394.

shows, I interlined the words above cited relating to the heavens; and, in so short and transitory an interlined hint of things, the expression of the proportion may well be excused. But if you consider the nature of the hypothesis, you will find that gravity decreases upwards, and can be no other from the superficies of the planet than reciprocally duplicate of the distance from the center, but downwards that proportion does not hold. This was but an hypothesis, and so to be looked upon only as one of my guesses, which I did not rely on; but it sufficiently explains to you why, in considering the descent of a body down to the center, I used not the duplicate proportion. In the small ascent and descent of projectiles above the earth, the variation of gravity is so inconsiderable that mathematicians neglect it. Hence the vulgar hypothesis with them is uniform gravity. And why might not I, as a mathematician, use it frequently, without thinking on the philosophy of the heavens, or believing it to be philosophically true?"[67]

In the body of this letter, Newton said:[68] "Between ten and eleven years ago, there was an hypothesis of mine registered in your books, wherein I hinted a cause of gravity from the superficies of the planets (though for brevity's sake not there expressed) can be no other than reciprocally duplicate of the distance from the center. And I hope I shall not be urged to declare, in print, that I understood not the obvious mathematical conditions of my own hypothesis."

In a letter to Robert Boyle, which was written on February 28, 1679,[69] Newton said: "I shall set down one conjecture more which came into my mind now as I was writing this letter: it is about the cause of gravity. For this end I will suppose ether to consist of parts differing

[67] Rouse Ball, *op. cit.*, pp. 161-162.

[68] *Ibid.*, p. 158.

[69] This letter is reproduced by Brewster, *op. cit.*, pp. 409-419. The passage given is on pp. 418-419.

from one another in *subtlety,* by indefinite degrees; that in the pores of bodies there is less of the grosser ether in proportion to the finer than in the regions of the air; and that yet the grosser ether in the air affects the upper regions of the earth and the finer ether in the earth the lower regions of the air, in such a manner that from the top of the air to the surface of the earth, and again from the surface of the earth to the center thereof, the ether is insensibly finer and finer. Imagine, now, any body suspended in the air or lying on the earth; the ether, being by the hypothesis grosser in the pores which are in the upper parts of the body than in those which are in its lower parts, and that grosser ether being less apt to be lodged in those pores than the finer ether below, it will endeavor to get out and give way to the finer ether below, which cannot be, without the bodies descending to make room above for it to go out into."

In this letter to Boyle, Newton deduced, from the rarification of the ether between two bodies which approach one another, firstly, an endeavor of these bodies to recede from one another, and, secondly, their adherence to one another.[70]

On this passage Rosenberger[71] remarks: "This deduction of molecular attraction and repulsion shows clearly how far Newton then was from his system of primitive or elementary forces, which only differed by the law of the actions, of all matter."

It is to be noticed that Newton himself, although he rejected the undulatory theory of light because he did not think that this theory could explain the rectilinear propagation of light, considered the whole of space to be filled with an elastic medium which propagates vibrations in a manner analogous to that in which the air propagates vibrations of sound. The ether penetrates into the pores

[70] Brewster, *op. cit.,* pp. 412-413. [71] *Op. cit.,* p. 125.

of all material bodies, whose cohesion it brings about, it transmits gravitational action, and its irregular turbulence constitutes heat. Light, although it is not itself constituted by vibrations of this medium, but is composed of currents of corpuscles emitted by luminous bodies, freely traverses the ether. The ether has a density so small that it does not offer any sensible resistance to the heavenly bodies which move in it.[72]

Here may be mentioned two facts which, indirectly or directly, concern theories of ether with Newton and his predecessors.

Bullialdus derived the conclusion that the force of gravity varies inversely as the square of the distance by analogy with the diminution that occurs in the intensity of light; the opinions of Robison and Leibniz on the validity of this argument were given by Rigaud.[73] The hypotheses framed by Bullialdus, Huygens, Leibniz, John Bernoulli, and Newton, to devise some mechanical cause for the effects of gravitation were also noticed by Rigaud.[74]

X.

About 1677, Donne and Newton visited Wren at his lodgings, and Wren "discoursed of this problem of determining the planetary motions upon philosophical principles." This was stated in a letter from Newton to Halley of May 27, 1686,[75] and Newton added: "You are acquainted with Sir Christopher. Pray know where and whence he first learnt the decrease of the force in a duplicate ratio of the distance from the center."

[72] Cf. E. T. Whittaker, *A History of the Theories of Aether and Electricity from the Age of Descartes to the Close of the Nineteenth Century*, London and Dublin, 1910. Cf. also p. 534 of Mach's *Mechanics*.

[73] *Op. cit.*, p. 56.

[74] *Op. cit.*, pp. 59-63, and Appendix, No. xviii, pp. 65-66, No. xx, pp. 68-70, and No. xvii, pp. 62-64 (letter to Boyle).

[75] Rouse Ball, *op. cit.*, p. 156.

Halley replied to this request on June 29, 1686:[76] "According to your desire in your former, I waited upon Sir Christopher Wren to inquire of him if he had the first notion of the reciprocal duplicate proportion from Mr. Hooke. His answer was that he himself, very many years since, had had his thoughts upon the making out the planets' motions by a composition of a descent towards the sun and an impressed motion; but at length he gave over, not finding the means of doing it. Since which time Mr. Hooke had frequently told him that he had done it, and attempted to make it out to him, but that he never satisfied him that his demonstrations were cogent. And this I know to be true, that in January 1683-4, I, having from the consideration of the sesquialter proportion of Kepler concluded that the centripetal force decreased in the proportion of the squares of the distances reciprocally, came one Wednesday to town, where I met with Sir Christopher Wren and Mr. Hooke, and, falling in discourse about it, Mr. Hooke affirmed that upon that principle all the laws of the celestial motions were to be demonstrated, and that he himself had done it. I declared the ill success of my attempts; and Sir Christopher, to encourage the inquiry, said that he would give Mr. Hooke or me two months' time to bring him a convincing demonstration thereof, and besides the honor, he of us that did it should have from him a present of a book of forty shillings. Mr. Hooke then said that he had it, but he would conceal it for some time that others, trying and failing, might know how to value it when he should make it public; however I remember Sir Christopher was little satisfied that he could do it, and, though Mr. Hooke then promised to show it him, I do not yet find that in that particular he has been as good as his word."

PHILIP E. B. JOURDAIN.

CAMBRIDGE, ENGLAND.

[76] *Ibid.*, pp. 162-163.

THE UNITS OF MEASURE AND THE PRINCIPLE OF RELATIVITY.

"Mathematica, quae philosophiam naturalem terminare, non generare aut procreare."—Bacon.

THE ideas which underlie scientific hypothesis, however diverse they may seem to be, rest on a common mechanical base. All phenomena are therefore explained as being due to some special form of mechanical motions of bodies, and can be reduced ultimately to modifications of inertia, velocity, momentum, or energy. These hypotheses have, in addition, this common property: they begin with the postulate of an entity which possesses inertia and velocity. Various names have been attached to this entity, but whether it be called an atom, an ether, a vortex, electricity, or energy, its function is the same. While there is little difference in the nature of this entity or substance, yet there are two diametrically opposite ways of considering its space attributes which give rise to two irreconcilable schools of thought. One of these believes the primordial substance to be discontinuous, with its parts separated by vacuous space, and the other school just as confidently maintains that there *can be no empty* space and that substance is continuous. Arguments for and against these two views have been unceasing and are likely to continue so long as hypothetical methods remain in vogue. The problem is quite incapable of solution because the postulate

of continuity or discontinuity is a matter of conviction rather than of reason. The fact is, we believe one or the other to be true and that is the end of it. In such discussions where a postulate is quite beyond our powers of verification by experience, each contestant chooses his starting point, and this once chosen, his argument in favor of it is as sound as that of his opponents. And the truth of this assertion is evident, because from these diametrically opposite postulates, conclusions which are quite identical are deduced by equally logical arguments; witness the controversy between the atomists and the Cartesians which see-saws through all scientific theory and is as far from settlement to-day as it was centuries ago. This dualism, as it may be called, is not confined to science; it is but one phase of that larger dualism of philosphy and ethics which has come down to us from the Greek thinkers; the claims of two opposing schools of thought are always present to show us that, if the mind can develop a system from one set of postulates, the same results can be obtained from their contraries.

If then our conception of the nature of things is but a matter of personal conviction, what value is there in the opinion of Professor Lorentz, that, if we wish to obtain an insight into the mysteries and operations of nature, we must make hypotheses? If such hypotheses are not capable of proof then they must rest on what Bolingbroke so aptly calls our inward sentiment of knowledge. The experimentalist who described phenomena from his inward sentiment of what they should be, rather than from observations of what they are, would be classed as a nuisance. Such a one not only does not advance our knowledge but he actually retards it, since his work must be repeated before the truth can be known. So, too, the theorist who relies on hypotheses and not on facts and laws builds a structure which is not only temporary and false but must

be torn down. If we relegate to metaphysics, so large a part of what is commonly called physics, what is left to the science of physics? The answer probably is to be found in the saying of Lord Kelvin, that no scientific statement is understood until it is measured. If we grant this, then we must examine, in such a discussion as this, our methods of measurement.

The statement of a phenomenon invariably contains two terms, called qualitative and quantitative factors; the former expressing "what kind" and the latter, "how much." Thus, when we speak of a distance as ten centimeters, we mean that we are to consider a quantity ten of the quality, length. Now it is not really the province of science to seek for absolute knowledge of either qualities or quantities, and the attempt to do so is the excuse for hypothesis. What science is concerned with, is the relative knowledge, or comparison, of different quantities of any given quality and the reduction of complex qualities into combinations of simpler ones.

It thus becomes of prime importance to settle on the simplest and most fundamental qualities which may serve as a foundation for our system of measurement. Because of the fact that mechanical motions and mechanical forces are the most readily perceived by us and are most easily expressed in mathematical formulae, the fundamental units of quality are always selected from mechanical concepts. Of these, length, time, and mass, are found to be incapable of further simplification and have been adopted as the units of measurement. As these qualities must enter into all equations quantitatively, and as we can have no conception of an absolute quantity, we have by statute fixed upon certain arbitrary standards of quantity, such as the centimeter and foot for length, the gram and pound for mass, the second for time. From these prime standards all other quantities of a mechanical nature may be readily derived;

as, for example, velocity is the quotient of a given length by a time; momentum is the product of a mass and its velocity; energy, one-half the product of a mass and a square of its velocity, etc.

The science of mechanics is the only branch of physics which has a completely developed theory. Not only is this the case, but the other branches of physics have been developed from a mechanical basis, in so far at least as the measurement of all phenomena is now made in terms of these mechanical units. This coordination in physics has the great advantage of making it possible to express what are apparently unrelated phenomena by combinations of only three standards of measurement and by a few general equations of mechanics, and we attain the additional advantage of expressing all these phenomena in the most concrete form imaginable. But, on the other hand, this method produces a serious break between physics and certain other sciences, especially those which rely more exclusively on the sense-perceptions as criteria for classification of phenomena. Thus, to the physicist light of different kinds is distinguished only by the three qualities possible in a mechanical wave; namely, its wave-length, the amplitude of its disturbance, and the complexity of its form. These same qualities must also serve to distinguish sounds, water waves and many other types of this kind of motion. For the biologist and psychologist, light is distinguished by its tint, intensity, and saturation, the three qualities which affect the sense of sight; and sound is determined by pitch, loudness, and timbre, which affect the auditory nerve. As there is no relation between the sensations of sight and hearing, so there can be no connection between light and sound. While the method of the physicist has the great advantage of unity, yet it suffers from its artificiality, as it tends to bring into undue prominence the mechanical energy involved in producing light

and sound and ignores the more important properties of these phenomena, their effect on our senses.

It is generally conceded that we have no abstract or absolute knowledge of a quantity of length, time, or mass. In other words, we can express any of these three quantities only as a numerical ratio with respect to a predetermined standard of the same quantity, such as a yardstick for length, a pound for mass, and a given motion of a clock-hand or of the rotation of the earth for time; and from this fact, it is often argued that we cannot form any idea of the qualities, space, time, and matter, except as they are individually and concretely measured. Kant, to be sure, maintained that we were endowed with an innate and inexplicable, but sufficient, idea of pure space and time. These qualities are, however, by themselves inappreciable to our senses. To make them sensible, we need a third, which he calls the *Ding an sich,* corresponding in the external world to what we call the entity, matter.

However vulnerable and unsatisfactory the doctrine of innate ideas may be, yet it seems to me that by the abstractive method as used in the science of mechanics we obtain a real and adequate idea of these three fundamental postulates. If we have not such a power of abstracting real ideas from our concrete observations of phenomena, then it is difficult to believe that the conclusions of Euclidean geometry and of mathematical analysis in general are rigorous. Thus, in mathematical definitions, space is a mere volume enclosed in an imagined boundary which may be conceived as of any extent from the indefinitely small to the indefinitely large. And this imagined bounding surface bears no closer relation to a concrete material envelope than does an image in a mirror to its object. It seems to me that I have an adequate idea, for instance, of the space in an empty room and that I can abstract all the properties from my concrete perception of the ma-

terial walls of this room except the one fact that they enclose this space. By deduction and by experience I am convinced that this space is not empty, but contains air. But it is really more difficult to appreciate the existence of the air, if it be at rest, than its non-existence. This belief is borne out by the slow advance in the conception of the existence of gases. And it also seems true to me that I have an adequate idea of an area enclosed in a triangle, because I can think of the area enclosed by three abstract lines and refrain from thinking of the concrete volume of any real lines drawn with a pencil.

As for the concept time, we have a twofold sense of it; one is the coincidence of an event with the position of the hands of a clock or of the earth. But we have, in addition, a much more general idea of time, as mere succession of events without any reference to such a standard of measurement as the second or minute. This might be called our belief that events entirely unconnected with our own experience occur successively just as those events do which we compare with a clock. We have, on awaking from sleep, a distinct and clear idea that events have transpired successively during our unconsciousness and without any reference to a measured interval of time. This general knowledge of "before and after" is apparently possible to an animal; a dog will with certainty expect a reward after the performance of a trick and not before or during it.

As for the third postulate, which is called matter, it may be taken in the most general sense as the something which makes space and time concrete to us. The necessity in science for such a postulate is clear, for science deals with the phenomena of an objective world. Even those men of science most opposed to the idea that mass is the measure of matter, still postulate an entity identical with matter, as just defined, although they may call it by a

different name, such as energy, electricity, etc. The distinction between mathematics and science lies in the conception of this third postulate. In pure mathematics matter becomes the abstract postulate, quantity. When discussing velocity abstractly there is then no need to consider the properties of the things moving, but in physics there is such a need. Or again, when dealing with space relations the mathematician is in no way limited to the restricted number of three dimensions which our sense-perception of the material universe imposes on science.

The supreme value of mathematics to science is due to the fact that scientific laws and theories have their best, if not their only complete, expression in mathematical formulae; and the degree of accuracy with which we can express scientific theory in mathematical terms is the measure of the state of a science. Thus it is possible to classify sciences according to their development, from the accumulation of statistics of phenomena to the generalization of these phenomena in comprehensive and rigorous laws. In such a classification, sociology or the study of existing society occupies the lowest rank, since true laws can be derived only from actions whose completed consequences are known. Sociology therefore attempts to found its laws on the data of history, the study of past society; history must in the same way rely on psychology, which deals with the actions of the individuals of society; psychology relies on biology; biology, on chemistry; chemistry, on physics; and physics on pure mathematics. While each science thus strives to found its laws on the conclusions of the following science, each succeeds only partially; this leads us to a paradox. The goal of science is mathematics, and while mathematics may be said to be the only true science since it has the only true scientific method, mathematics is no science because it deals with abstractions and ignores concrete phenomena.

As stated before, all quantities in mechanics may be expressed by combining the fundamental units—length, mass, and time—in simple ratios and products. And while the phenomena of light, heat, and electricity do not manifest themselves directly to our senses in any manner which may be coordinated with mechanical actions, yet we endeavor to measure them in physics as if they were mechanical in nature. Thus we speak of the velocity of light from the sun to the earth, as if we were considering a real mechanical motion of a ponderable body, although in the intervening space there is no matter. The only thing we have been able to observe is that light emitted from the sun appears on the earth some time later. Light as a phenomenon does not exist unless it is associated with matter; we can no more discuss the amount of light or its velocity in absolutely vacuous space than we can speak of the temperature of such space. Light has a true mechanical velocity when passing through space occupied by matter, for then we can observe and measure its path as well as the time function and so obtain a value for velocity. From observations on the velocity of light in matter and from analogy to the phenomena of sound transmission, which takes place only in spaces occupied by matter, we by the hypothetical method transfer the measurements and laws of light in transparent bodies to space not occupied by matter. The very assumption of a light-velocity in immaterial spaces requires us also tacitly to assume that *something,* in a mechanical sense, is moving. Once we have granted that light is something moving, then all the other phenomena of light permit of a hypothetical mechanical explanation, and we have the right to speak of the momentum and energy of this light something, whether it be corpuscles or waves. But it is the easiest thing in the world to forget that we can never obtain any real knowledge of this something we have called light. It is surprising that men of

science should believe that they have proved the existence of the ether, as when Sir Oliver Lodge states that it is the most massive thing imaginable; or that space is occupied by energy, an entity possessing inertia and probably gravitational force as Professor Einstein announces: they should see that such statements are not deductions made from our experimental knowledge of light, but are already contained in the hypothetical postulate that light is mechanical and has a mechanical velocity.

It is instructive to consider, in this connection, how we also have attached hypothetically the science of electricity to mechanics. The fundamental phenomenon observed, when bodies are electrified or magnetized, is that they attract or repel each other with a mechanical force which, like the force of gravitation, varies inversely as the square of the distance between them. In our fundamental units this mechanical force is equal to a mass times a length and divided by the square of a time. Now Coulomb, who discovered the law of electrical attraction, believed that electricity was a kind of fluid substance, such as was always introduced when phenomena were obscure; and with this idea in his mind, he employed the term "quantity" of electricity to indicate an analogy with a quantity of matter. On this supposition, a quantity of electricity expressed in mechanical units is equal to the square root of a length times a mass. Now it is quite certain that a quantity of electricity has nothing in common with length. Taking a step further, we find that the resistance of a conductor to an electrical current must be expressed as a velocity. Yet it would be absurd to attach any concrete relation between electrical resistance and mechanical velocity.

These three examples of velocity illustrate quite clearly the difference between the abstractive and hypothetical methods. From the definite and clear idea of the mechan-

ical velocity of a concrete body, we pass to an indefinite idea of the velocity of light in empty space, and in order to link this idea to mechanical notions, we assign to light a hypothetical material existence. But our mathematical equations lead us a step further and we can derive a purely formular relation between mechanical velocity and electrical resistance; in this case analogy between physics and mathematics entirely fails and no idea, even hypothetical, has been attached to the result.

The principles of the science of mechanics, on which the theories of the other branches have been built, date from the time of Galileo and Newton. As they had withstood the searching criticism of the masters of the science for centuries, without having been shown to be either false or inadequate, the belief grew that however other theories of physics might change, the laws of mechanics as stated by Newton were probably final. But it is inevitable that if we found the laws of light and electricity on mechanics, the time will come when the accumulation of knowledge will increase the discrepancies which must always exist between any two branches of science and will eventually require a thorough revision of one or the other. If the attention be directed more toward discovering the phenomena and laws of light and electricity than of mechanics, as it is to-day, any discrepancies will probably be laid to the laws of mechanics and their revision will be attempted to ensure agreement. This has occurred in the last few years, and the mechanics based on material bodies is being replaced by a mechanics of electricity or by one of energy, if the terms be permissible.

The mechanics of material bodies, to which the name of Newton is generally attached, was based on the objective reality of matter, whose quantitative measure was inertia or mass. Newton evidently considered inertia as a fundamental attribute of matter, and thus invariable and in-

explicable; something to be accepted and determined solely by experiment. Thus he says in his *Principia*: "Haec (materiae vis) semper proportionalis est suo corpore, neque differt quicquam ab inertia massae, nisi in modo concipiendi. Per inertiam materiae fit, ut corpus omne de statu suo vel quiescendi vel movendi difficulter deterbetur." This postulate may be freely translated to mean that the force of attraction of matter is always proportional to the amount of matter acting, and does not differ in any way from the inertia of mass except in our method of apprehending it. By inertia of matter is meant, that a body can be changed from its previous condition of rest or motion only by this material force. It is evident that he regarded inertia as an inherent and inalienable property of a body, independent of the influence of any other body or ether, and forming a connecting and stable link between ourselves and the external world. Such being the case, how may we decide what is the mass of any particular body? If a number of individuals measure experimentally a mass, or even if one of them measures it several times, no two observations will agree. Which observation gives the correct value? Newton would have answered, none of them. Data of objective phenomena can never be known exactly; each value we obtain approximates to the truth, and the approximation is the closer, the greater the number so obtained and the greater the care exercised. The final result must be deduced from all the observations, according to a well-developed mathematical theory of errors. The same reasoning was held to apply to observations on the space-dimensions of a body and on the time occurring during any event.

While the idea was advanced in this mechanics that the position and motion of any body could be determined only from the position of some other body, supposed for the time being to be at rest, or that position and motion

were relative and not absolute; yet it was not explicitly stated that there could not be absolute rest or motion, such as would occur if the motion of a body were referred to an absolutely fixed center of the universe or to an ether which was incapable of motion. For all practical problems, Newton's third law of motion, which states that to every action there is an equal and oppositely directed reaction, announces the universality of relativity.

We should finally note that mass, dimensions, and time were held to be unaffected by the motion of a body. Newton expresses this by saying that force-actions of matter, or the science of dynamics, are independent of its initial state of rest or motion.

The first serious criticism of these postulates was made by a number of physicists, forming what is often called the school of energetics, who proposed to substitute energy for mass as the fundamental attribute of matter. At the time, the change was rather immaterial as we were accustomed to think that mass and energy were coexistent and that either one was unintelligible without the other. It was the same kind of a problem as deciding which came first, the owl or the egg; the answer to which is that we know nothing about the matter.

The discrepancies in mechanics did not prove to be embarrassing until certain problems connected with light and electricity became pressing. Of these, three stand out most prominently.

The phenomena associated with electricity, when it passes through very high vacua, and with radioactive bodies like radium, are now explained as being due to the action of excessively small particles, carrying a charge of electricity and moving with a velocity comparable to the velocity of light, or about one hundred thousand miles per second. These particles, both because of their smallness and because of their velocity, are in an entirely different class

from the bodies previously considered in mechanics which have a sensible mass and whose greatest velocity is less than one hundred miles per second. Errors in mechanical laws which would otherwise be inappreciable may easily assume large proportions when applied to such extreme cases. The hypothesis of the electron has profoundly modified the conception of the atom, and the nature of matter and motion.

In the second place, recent experiments lead to the belief that matter is always electrified; that light is due to electrical variations; and that the amount of electricity associated with a given amount of matter is a fixed and invariable quantity. It was further shown by theory and confirmed by experiment that if an electrified body be moved, the ratio of its electrical charge to its mass must vary with the velocity of its motion; and since the electrical charge is held to be a constant, there remains only the alternative of considering the mass of a body as a variable. This evidently strikes at the very root of Newtonian mechanics. The effect of motion on mass is found to be inappreciable until the velocity approximates to that of light, so the discussion would have remained a purely academic one if the discovery of the electron had not brought us suddenly face to face with bodies which are supposed to have a velocity great enough to affect experimentally their mass. A further consequence of this theory is that mass becomes infinite when the velocity of light is reached. While this velocity has always been considered enormous and beyond our power to attain, such a result was entirely unsuspected. The laws of dynamics of bodies at rest could evidently no longer be held to be the same as those for bodies in motion.

Lastly, various experiments have been made to find an effect due to the mutual relations of the ether and matter. None could be found. One in particular, devised by

Professors Michelson and Morley, has proved to be the hardest problem in modern physics to explain. Calculation showed that certain properties of light should be affected appreciably by the motion of the earth through space, but the experiment proved beyond doubt that such was not the case. The first attempt at an explanation was made by assigning certain complicated motions to the ether which would annul the effect the motion of the earth should produce; but it was shown that unless the ether remained absolutely at rest worse difficulties resulted. Then the bold assumption was made, often called the Fitzgerald-Lorentz effect, that the dimensions of bodies in motion were so changed by their motion as to neutralize the effect of the earth's motion on the phenomena of light. Every body would, according to this idea grow shorter, the faster it moved; and would flatten out to nothing if it could attain a speed equal to the velocity of light.

One of the results of this criticism of mechanics has been to change profoundly our ideas of the ether. As is well known, the early conception of the ether was a kind of material substance possessing properties incompatible with those of any other kind of matter. A large part of the effort of theorists down to the middle of the nineteenth century was devoted to inventing attributes for the ether which would enable it to fulfil its function as the medium for the transmission of light. At this time, Faraday discovered an effect in electricity which required an entire change in our ideas of the ether. When he found that static electric charges and forces were dependent on the characteristics of ether, and when later Hertz showed experimentally that electromagnetic energy passed through the ether, and that this form of radiant energy was undoubtedly of the same type as light and heat; then it was found that no material ether could be imagined which would perform these new duties, especially as it was al-

ready staggering under the burdens of the old ones. Faraday proposed as a substitute that we should no longer imagine the ether to be a substance having material or mechanical properties, but one responding to electrical and magnetic actions. He was far in advance of his time and to be acceptable the hypothesis needed the mathematical development which was so skilfully accomplished by Maxwell. Both Faraday and Maxwell, while really destroying the material nature of the ether, strove to maintain at least a partial connection between electro-magnetic and mechanical attributes. For this reason they supposed that electromagnetic stresses manifested themselves by creating mechanical strains in the ether and in matter immersed in it. Such strains must produce actual physical deformations of size and shape in all electrified bodies. It has been shown experimentally by the writer that such deformations are not produced in electrified matter and lately Professor Lorentz has stated, that since Helmholtz proved these stresses would cause the ether to move, and since no experiment has ever shown us a trace of a motion in the ether, we must deny the real existence of ether stresses. The effect of such a denial is to separate all attributes of the ether from concrete realities and to class them as abstract symbols. Professor Lorentz is quite explicit on this point, as he holds that, "while thus denying the real existence of ether stresses, we can still avail ourselves of all the mathematical transformations by which the application of the formula (for these stresses) may be made easier: ....and for convenience's sake we may continue to apply to the quantities occurring in this integral the name of stresses. Only, we must be aware that they are only imaginary ones, nothing else than auxiliary mathematical quantities." The dematerialization of the ether, when it was once found that light and heat still managed to come to us from the sun although its medium of transmission

had received such a rude shock, has progressed rapidly until to-day many accept the postulate that there is no difference between absolutely vacuous space and the ether except that the latter is the temporary seat of radiant energy and possesses a light vector. If this last definition of the ether means anything in a concrete sense, it implies that light has the power of changing a vacuum into an ether. When we stop to think that a vacuum means negation of everything, we realize what extraordinary things light and the ether are in modern physics. Just consider this statement of Professor Einstein, which is considered almost authoritative, "the places in space where these electro-magnetic actions (i. e., light) occur are here considered not as states of a sort of matter, but as self-existing things which are similar to ponderable matter and in common with it have the characteristic of inertia." One has merely to ask, what becomes of these self-existing things when light ceases to go through a certain space and it slips back into its state of vacuity?

Without going into details, we find a like trend in the hypothesis of the nature of matter. It began with the atom, as a minute simulacrum of ponderable bodies and then we proceeded to strip away one concrete attribute after another until for a brief interval matter was a manifestation of an entity, electricity. But even this idea was too concrete, too material, to serve and now the objective universe is the symbol, energy.

If we finally subscribe to these ideas, are we not really acknowledging that hypothetical science has failed as the interpreter of an objective world? It seems to me the guides to knowledge are now to be found in those subjective impressions which must depend on the individual and vary with him. Scientific laws are thus not facts to be discovered but the temporary consensus of opinion of a number of individuals who, for the time being, find them-

selves in agreement. The classical natural philosophy of Newton and Galileo has drifted into the transcendental symbolism which is apt to occur when German thinkers become the leaders in philosophy.

Evidently an almost chaotic condition had developed in our ideas of space, matter, and electricity. Each theorist advanced an hypothesis of the most tentative character which all felt to be inadequate. Yet in spite of the confusion, three points of agreement may be noted. In the first place, the ether as a material substance was impossible and even useless; the name, it is true, was left but it expressed now but the shadow of a reality. When the ether is called an electro-magnetic something, or a space differentiated only by the transient presence of energy, the name may signify something but it is hardly intelligible except as a mathematical symbol. Secondly, these theories agree in assuming electricity to be an entity; that is, we are to suppose that it is not due to a state of matter manifested by a special mechanical force, but a substance like matter, divisible into atomic elements and having inertia. Thirdly, the mass inertia of matter is not an invariable quantity but changes with the velocity of a body; thus it is the measure of matter only while there is no motion.

Such was the state of physical theory when Professor Einstein announced, in an article published in the *Annalen der Physik* for the year 1905, a new scientific principle which he believes will reconcile the contradictions of our new hypotheses; satisfy the three conceptions mentioned; and correct and amplify the Newtonian mechanics so that it will again harmonize with modern science. Whether this "principle of relativity" will accomplish all that its discoverer hopes can be decided only after an exhaustive trial. But there is no doubt as to the startling effect it has produced on scientific theory nor of the far-reaching importance of its conclusions. For example, Professor

Planck is said to have declared that this new conception of time and space surpasses in boldness anything that has appeared up to the present time in speculative science.

The name, "principle of relativity," is derived from Professor Einstein's first postulate, which is as follows: The idea of absolute rest or absolute motion is an impossibility to the human mind, and not only in mechanics, but also in electrodynamics corresponds to no properties of phenomena.

In addition, he announced as a second postulate that the velocity of light,V, in empty space is an absolute constant of nature. Hence this velocity, contrary to all others, is independent of the motion of the body emitting and the one receiving the light. The startling nature of this postulate is readily understood when we remember that the closest analogue to light is sound, the velocity of which is known by experience to be dependent on these quantities.

He has recorded for us, that he became convinced of the necessity for these postulates, because the theory of electrodynamics developed by Maxwell leads to an asymmetry, when applied to moving bodies, which is not true experimentally. For instance, when a magnet and an electric conductor are moved with respect to each other, the phenomena of the forces developed are observed to depend only on the relative motion of the magnet and the conductor, but Maxwell's theory requires a different explanation according to which is moved and which remains at rest. Besides this discrepancy between observation and theory, experiments, devised with sufficient accuracy, fail to show any effect of the earth's motion through space on the phenomena of light.

It will be convenient to grant these postulates and to follow Professor Einstein's deductions before attempting any criticism. In the first place, their adoption does away with the possibility of an ether and revives the conception

of space as a vacuum. Both theory and experiment show that an ether must be in absolute rest with respect to the motion of the earth, and the first postulate denies the possibility of absolute rest and motion. Again, the failure of Newtonian mechanics lies in the assumption, which is always tacitly made, that moving bodies are subject to the same mechanical laws as those at rest. As I have already pointed out, the modification to be made in the laws for ordinary bodies is very minute and would probably never have become of importance if modern theory had not been interested in the properties of bodies moving supposedly with velocities approximating that of light.

The root of the error in the mechanics of moving bodies, Professor Einstein believes, lies in our determination of time, and clear thinking in regard to time is nearly all that is necessary to clear up the trouble. Suppose a body, or a material point to be at rest relatively to a coordinate system of three rectangular lines, then its position can easily be determined by the ordinary geometrical method of measuring its distance from each of the lines by rigid measuring-rods. But if the point is in motion with respect to the reference system, its position depends on time and cannot be determined by the geometrical method. Our idea of time is usually defined by what we call isochronism; we say an event occurs at seven o'clock, when the occurrence of the event and the position of the hour hand of a clock at seven are simultaneous. But suppose the clock were at some distance from us, then we could observe the hand to be at seven only after it had passed beyond that figure, since it would take some time by any method of transmission for the intelligence to reach us. As the velocity of light is the greatest of all known motions, the least discrepancy would be caused by using light signals as the mode of transmitting such intelligence. Also if we accept the second postulate, our intelligence will be still more

accurate because the velocity of light is unaffected by other motions and we thus avoid the difficulty caused by the question whether any relative motion between us and the clock is an approach or a separation. To illustrate further our confusion as regards the measurement of time, suppose two persons wish to record two events, which we shall grant to be simultaneous, occurring at different places, A and B. An observer at A records the event when it occurs at A as being at T_A time, and instantly signals the fact to an observer at B. Whatever the means of signalling, a certain time will elapse before the observer at B is cognizant of it. For the reasons given, we shall adopt light signals as the best method. B observes the signal as T_B time by a clock placed at B and immediately reflects it back to A, who receives it at T'_A time by his clock. Although we have granted that both events were simultaneous, it is evident they will not be so recorded by the two observers. B will record the event at A as being later than the one at B. But if the velocity of light be absolutely independent of all conditions, then we should find that the differences of time going and returning are the same, or $T_B - T_A = T'_A - T_B$. This relation, if satisfied by any two events occurring at a distance from each other, is Professor Einstein's definition of simultaneous events or isochronism. The definition may be put in this form: Two events are simultaneous, if the difference of time to flash a signal there and back is equal to twice the distance between the two positions divided by the velocity of light, V.

Not only does this limitation in our inability to measure time affect our ideas of time, but it also has an important and unsuspected influence on our ideas of the size and shape of a body. This may be shown by an example. Suppose we wish to measure a rigid rod of length, l, moving in the direction of its axis with a velocity, v, then there

are two methods of measuring this length and they do not give concordant results.

First an observer may move with the rod and measure its length by applying to it a measuring-rod. He will evidently obtain the same result as if both he and the rod were at rest.

A second method is possible and is frequently employed. An observer remains at rest and notes the positions of the two ends of the rod, at a certain time, t, which he determines by means of clocks, also at rest and tested for synchronism. These two points are dependent on our ability to record simultaneous events; if the rod were at rest the problem would be the one already discussed, but in this case the rod has a velocity, v, and consequently the time used in signalling in one direction involves, $V - v$, and in the other $V + v$. So when he measures the distance between the two points, which may also be called the length of the rod, he will find it not equal to l as determined by the first method, if he still regards his clocks as isochronous; or if he determined two positions whose measured distance is l then his clocks will not be isochronous.

Now our measurements of length are usually made under the condition that we, clocks, and rods are all moving with the earth and so relatively at rest. Our measurements of length of bodies on the earth are thus different from those made on the same bodies by an observer stationed with his clocks in the moon. Also if an object on the earth is measured while it is moving with respect to the observer, it will have a different length from that which it has when relatively at rest. Thus the dimensions of a body are dependent on its velocity, and Newtonian mechanics, which assumes the contrary, must be modified when applied to bodies in motion.

Professor Einstein then derives a set of equations which will express the dimensions of a moving body as they

appear to a stationary observer. These show that the length of every body moving with a velocity, v, is diminished in the direction of its motion by the fraction

$$1/\sqrt{1-(v/V)^2},$$

and its dimensions at right angles to its motion are unchanged. Thus a sphere in motion becomes an ellipsoid flattened in the direction of its motion by an amount equal to the above fraction. It is proper to say, that this effect is quite inappreciable at ordinary velocities. This is true even of so great a velocity as that of the earth around the sun. This velocity is about thirty kilometers per second while V is 300,000 kilometers per second. One diameter of the earth would thus, to an observer in the sun, appear shortened about 7.5 centimeters, or three inches. But this effect becomes quite important for velocities approaching one-tenth of V. And a velocity equal to that of light is absolutely unattainable because the length of the moving body would then be reduced to zero. So we have the curious anomaly of a finite velocity producing an infinite effect.

The same equations also show that if one of two clocks, which are synchronous when at rest, be moved with a velocity, v, the stationary clock will run faster each second than the moving one. The maximum value of the difference is when one clock runs infinitely faster than the other.

We must not lose sight of the fact that this discussion, so far as mechanical bodies and motions are concerned, is purely academic, because for them the ratio v/V is too small in any known case to have an appreciable effect. The principle of relativity has its greatest significance when applied to problems of electricity, provided we accept the theory of electrons. If the atom of matter be composed of particles of electricity, if the inertia of matter be variable and due to electrical reactions, and if the velocity

of the electron approaches that of light, then the effect of its velocity on its shape, size and mass is an important matter. For, let m be the mass of an electron at rest, from Professor Einstein's formulae, its apparent mass in the direction of motion is

$$\frac{m}{\sqrt{1-\left(\frac{v}{V}\right)^2}},$$

and its mass at right angles to the motion which would make it resist change of direction is

$$\frac{m}{1-\left(\frac{v}{V}\right)^2}.$$

Thus we have the unusual result of not only a variable mass, but also a difference in mass according to the direction considered. There is a close analogy between this apparent increase in the inertia of a moving electrified body and the increase in the inertia of a body moving in a fluid. In the hydrodynamic problem, we do not find it necessary to consider the real mass of the body as variable, since we can attribute its apparent variation to the energy required to set the fluid in motion. We may, in a similar manner, for the electrodynamic problem, ascribe the apparent increase in mass to the energy necessary to overcome the reactions of the electromagnetic field through which the body moves, and thus keep the mechanical mass constant.

Another consequence of the hypothesis is that mass also depends on energy. This result is of extraordinary importance, for it means we have no ability to distinguish between the inertia of a physical system of bodies and its energy; in other words, between the inertia of a body and the energy content of the space surrounding it. When we recall Professor Einstein's conception of space and energy, which I have quoted, most persons will become

convinced that no idea of the nature of matter could be more abstract. The mass of a single body thus remains constant only when its energy remains constant. If it gives out heat, light, or electromagnetic energy, or if it even moves, its mass continually decreases, until, theoretically at least, it would melt away into a complex of energy. I know of no name to designate so immaterial a thing as this complex of energy, located somewhere in vacuous space. To be sure the interchange between mass and energy is very slow, so slow that ordinary minds grow skeptical of its existence. Thus a body radiating enough heat to warm a kilogram of water, one degree Centigrade, would decrease in mass only about 4.6×10^{-11} grams. It is fortunate that mass dissipates so slowly or we should indeed be things dreams are made of.

The last deduction I shall note is that the temperature of a moving body is less when measured by a moving observer than by one who is stationary.

Such are some of the more important conclusions which have been derived from the principle of relativity. If they can be established and men can be persuaded that the universe is, or even may be, as they indicate, a revolution has been accomplished in scientific thought. The postulates are apparently so simple and at the same time so bold, the conclusions are deduced by such rigorous mathematical development, that we must give the highest praise to this memoir in which so many of the perplexities of modern science are attacked. If we are to criticise the conclusions of this hypothesis, and they are opposed to what seems reasonable, it must be done by examining the postulates; in them, as in all hypotheses, lies the real strength or weakness of the system.

Professor Einstein asks us to accept two postulates. The first is: We have no ability in us to determine abso-

lute rest or motion. We can say only that one body is at rest or changes position with respect to others. Phenomena are conditioned entirely by the relative positions of bodies and we can gain nothing toward this explanation by introducing the idea of absolute position. The second postulate is: The velocity of light, V, is a universal and absolute constant.

Apparently no objection has been made to his statement that these two postulates are sufficient from which to derive all the conclusions mentioned. But it seems to me that at least two more independent postulates are advanced in the memoir on relativity, which must also be granted. I shall propose as a third, Professor Einstein's definition of time; and as a fourth, the assumption of the atomic nature of electricity. The fourth postulate carries with it as corollaries, that the amount of electricity per atom, or the electron as it is called, is a universal constant, and that the mass of the electron is variable. My excuse for offering them is, they cannot be derived from his postulates, and his conclusions require them.

The first postulate can be granted at once and unreservedly for all purely mechanical motions of bodies. These involve merely changes of position and do not affect the nature of bodies nor their phenomena. But it must be accepted with limitations when in addition to mechanical motion (and by mechanical motion I mean a mere change of position) one body is emitting energy in the form of heat, light or electricity, and the other receiving it. True relativity requires a strictly symmetrical arrangement. Now the mechanical motions of two bodies with respect to one another are symmetrical. If a body has a velocity, v_1, to the right and another a velocity, v_2, to the left, they approach each other with a velocity, $v_1 + v_2$. The same result is obtained if the velocities are interchanged. This symmetry is not the case if the first body is emitting en-

ergy and the second receiving it. The behavior of each is then conditioned by the behavior of the other and in an asymmetrical manner. As an illustration: Let a body, by a periodic disturbance of its parts send out a wave of heat; this proceeds, according to theory, through space in all directions and on encountering a second body produces a periodic disturbance in it. The effect of this energy is twofold; the motions of the parts of the two bodies are symmetrical but the wave itself does not proceed from the second body in all directions but only in the one already impressed upon it by the first body. To make this clearer, we may start a wave along a stretched string by plucking aside one part of it; the wave will travel along the string in two direction, causing successive parts to vibrate symmetrically, but these parts will send the wave in one direction only. So we may say the velocities of two bodies are relative because the quantities appear in the mathematical expression in a symmetrical manner; so also are their momenta or their masses multiplied by their velocities. But this is not the case for energy since it involves the square of the velocity. The squared velocity remains positive although we change direction and the composition of two energies is always an addition. For true relativity, a change in direction must be accompanied by a change in sign. The extension of the idea of relativity to involve cases of radiant energy is partly responsible for the conclusion that mass is a function of energy.

Professor Einstein's second postulate has been widely discussed and many attempts have been made to interpret it. At first sight it seems absurd to say that the motion of a body emitting light does not affect the velocity of the light emitted. But the fact remains that all our experiments, and they have been most accurate and searching, fail to find any difference in the velocity of light whether the sources and the recipient are at rest or in

motion. As we have seen, Professor Einstein, with admirable directness, goes straight to the point. He accepts the reliability of these experiments; assumes the constancy of V as a postulate, determines its effect on the space-dimensions of bodies and on time, and finds that we must change our previous ideas of these radically. Let us, when discussing V, consider it under two heads: first, when light passes through transparent material bodies and is subject to experimental verification; secondly, when it passes through space absolutely deprived of material bodies and so is not subject to experimental evidence.

In the first case, we know that there is a true path and that light moves very approximately in straight lines, and we have quite accurately measured the time light requires to move from one place to another through various substances. V is here the length of path divided by the time —a true velocity. We know that this V is a variable; it is less in water than it is in air, and still less in glass. It is also less in dense air than in rarefied air. Not only does V vary with the kind of matter through which light passes, but it also depends on the motion of the medium as shown in the experiments on the velocity of light passing through columns of moving water made by Fizeau and repeated by Professor Michelson. The velocity of light in material media is therefore subject to the variations which influence the velocity of sound and other types of motion and evidently cannot be the V assumed by Professor Einstein to be an absolute constant.

He must then limit his postulate strictly to what is called the velocity of light in absolutely immaterial space. There are two methods of obtaining this value. We observe the difference in time between the calculated eclipse of some satellite and the recorded observation of the event or we use other stellar phenomena. If we know the distance and the time, we say the velocity of light in empty

space is the quotient of the two. Such observations are quite inadequate to settle experimentally the question of the constancy of V. Our measurements of the distances are crude for such a purpose, and also the light must travel part of the way through a material such as the air. Neglecting such astronomical methods, we have left only determinations of V made on the earth where the path is necessarily through matter. Here, what we are to call the constant V can be found only by extrapolation. For example, we find that the ratio of the velocity in air and in water is about four to three and agrees with their refractive indices. We find also that the velocity in different gases as they are reduced in density, tends to a common value, which is independent of the kind of gas. If we take this extrapolated value of 3×10^{10} centimeters for the velocity of light in empty space and assume the refractive index of space to be one, then we may calculate back and by this method we find the absolute refractive index of air at ordinary pressure to be 1.0002. Such an experimental method and such reasoning are highly unsatisfactory. In the first place, we start with measurements of lengths and time which are subject to experimental verification and calculate V; from these we pass to the supposititious V where only one factor, the time, is subject to experimental proof and the other factor, the length, is not, as we cannot experiment on the path of light in free space. But passing this objection, we have calculated from length and time determinations a value for V and Professor Einstein declares it to be an absolute constant. He then reasons backward that the length of a body and time determinations must be variables with motion, in order to keep V constant. Of course, if Professor Einstein wishes to look on the universe as a purely abstract conception, and if he wishes to make what we sometimes call concrete or objective phenomena correspond to his preconceived idea,

he *can* assume V in a vacuum to be a universal and absolute constant and no one can disprove it scientifically. But there are some who still cling to the idea that dimensions of bodies and time are not subject to our fancy, and who believe that if any quantities must vary, it should be those which we have no means of determining directly. And after all it is asking a great deal of us, to upset our ideas in order to explain at bottom a single experiment, that of Michelson and Morley, however accurately it has been performed and however puzzling its results may be. He has not even the justification his predecessors would have had. When the ether was believed to be a crystalline solid which vibrated with the passage of light rays, V had a real meaning although we could not determine it directly. When the ether was a substance which periodically varied electromagnetically, we could still say that V had a possible meaning. But the latest definition, that the ether is absolutely quiescent space to be distinguished from vacuous space only by the fact that it is the seat of an entity, called electromagnetic energy, and contains a light vector, makes the word velocity when applied to V, absolutely without meaning in any ordinary sense of the term. To speak of a motion in an absolutely quiescent space is a rather startling statement. The ether also becomes a local affair shifting back and forth in vacuous space according as light is present or not. The feeble light of a candle, apparently, changes nothing into something.

But aside from these considerations which lie in the debatable land and which will be decided largely by the temperament of the individual, there seems to be an absolute contradiction between the first two postulates as I understand them. If V be the value of the velocity of light in an absolutely quiescent ether and itself a constant, then the velocity of light in a material medium, such as air, is an absolute velocity or motion when referred to V. Now

the first postulate declares that we can have no knowledge of absolute motion and, in addition, that the explanation of phenomena are not conditioned by absolute motion.

The third postulate, which I have proposed as necessary for the system proposed by Professor Einstein, is his definition of time. He says that our time is defined by synchronism or the simultaneous occurrence of an event and the position of the hour hand of a clock at a certain position, the number seven for example. This is certainly not our idea of time but merely our method of measuring it quantitatively. If we did not have an adequate idea of time as the mere succession of events we should have no conception of what simultaneous occurrences are. His definition gives me the feeling that if I could make clocks go slower my life would become longer. In the review of his memoir, it was pointed out that his definition of simultaneity or isochronism, when combined with the constancy of V, led to the conclusion that two clocks which were synchronous when relatively at rest, would not remain so if one of them were given a velocity. Moreover the length of a body in motion decreases with respect to its length when at rest. It is certain that these results depend on the constancy of V. If we are willing to rest our knowledge of time and space on a value which by the nature of things can never be put to a direct test, I am convinced of the theoretical correctness of these results. But I am not willing to do so. I prefer to trust to the invariability of time and space phenomena, even if it requires V to be a variable, and time measurements to contain an unavoidable discrepancy. By so doing, I am aware that I may forfeit an explanation of the Michelson-Morley effect and of some others, but this loss is not overwhelming and we can afford to wait for an explanation until a future time.

I am the more willing to take this attitude, because I can see no means of applying the principle of relativity to

the test of experience. As we have seen, the velocity of light in any material medium is a variable and can be no more trusted than the velocity of sound.

Perhaps this illustration may make my meaning clearer. Suppose a race of men to exist who are blind and have no knowledge of electromagnetic radiation, but who wish to measure the lengths of moving bodies. They will undoubtedly be compelled to get this information and that of the synchronism of clocks by sound signals. It is evident, that observations carried out, under conditions similar to those imposed by Professor Einstein, would indicate that the length of a moving body underwent changes. And while they could make corrections for some of the effects, because sound waves are largely affected by the motion of media and of sonorous bodies, yet they would undoubtedly come to the conclusion that the dimensions of a moving body depended to some extent on its motion. Now, if we bestow sight on one of these men, he would be able to correct their measurements, because by his immensely more rapid light signals he could gain a much more nearly instantaneous value for synchronism. We are, at present, in the condition of this man. As we improve in our ability to measure the velocity of light under different conditions we shall, Professor Einstein thinks, get closer to the knowledge of the absolute V and to the relations for space and time which he has derived. But we may suppose men will some day find a kind of radiation which has a velocity greater than V and by its aid remove the conviction remaining in our minds that motion affects length and time. Calculation may show that material bodies cannot attain this velocity, but we are speaking of an immaterial radiation. To say that such a radiation is impossible is as futile, at least as unscientific, as for a race of the blind to say that there is no light; especially so,

as it is possible that gravitational attraction may involve a velocity of transmission vastly greater than that of light.

Since the motion of any ponderable body is too slow to make the ratio v/V an appreciable quantity, the only supposable case where this ratio can enter as a determining factor is in problems of radioactivity and the discharge of electricity through gases. In these, the particles of matter are supposed to be so small and to have a velocity so great that their mass and size are functions of their velocity. But to limit the applicability of the principle of relativity to such supposititious bodies as electrons, is to rob it of much of its importance, and we should hardly consider it one of the great principles of nature.

But even this is not all. If we wish to apply the principle to electrons, we shall need a fourth postulate. We must assume that a quantity of electricity is atomic in character; either the charge of electricity associated with what we call an atom of matter is an invariable, or, as it is now usually expressed, electricity is an entity which may be divided into invariable, equal, and indivisible parts called electrons. As a corollary to this postulate, the ponderable mass of an atom is a variable depending on its velocity. It will suffice to consider this postulate very briefly. It may be shown at once that the constancy of electric quantity and the variability of mass is not a necessary assumption. All experiments, which involve both these quantities, include them in the form of a simple ratio, e/m; where e is the quantity of electricity and m the mass of the electron. It is evident that any value may be given to this ratio by supposing either one of its members to remain constant and the other to vary, or by supposing both to vary in opposite fashions, and it may be shown that it is just as reasonable to keep m constant and to let e vary with the velocity as to make the contrary assumption. This is certainly possible until we have experimental evidence which

will determine our decision and this evidence is not likely ever to be at our disposal.

If we attempt to estimate the results which follow from the postulates of relativity, the first would be that Professor Einstein has proved that we cannot theoretically measure in space and time moving bodies exactly by the laws which apply to bodies at rest. The first postulate will be accepted for all mechanical motions and no further attempts will be made to find experimentally an absolute motion. But the second postulate contradicts the principle of relativity, if by V we mean the absolute motion of *something*—matter, energy, or light through quiescent space. If, on the other hand, V is understood to be the velocity of light in space containing matter, then it cannot be taken as a universal constant. The third postulate concerning time should not cause us to change our belief that the dimensions of a body and the unit of time are independent of velocity, but it should show us how to correct our measurements of moving bodies, as we must correct all subjective measurements of objective phenomena.

If we grant the assumptions of Professor Einstein, the theory of relativity is a perfectly logical system so long as we apply it to abstract systems moving with a constant velocity in a straight line. But I can find no evidence that the postulates agree with experimental facts and certainly, to the present time at least, its conclusions will not affect experimentally the laws of mechanics. Also its theoretical conclusions are limited, as yet, to the rare cases when there is neither any change of speed nor of direction. We should remember before we abandon or modify Newtonian mechanics that mathematicians have devised numerous systems which point to different mechanical laws. If we postulate a fourth dimension to space we can deduce perfectly logical laws for a mechanical system that is quite different from the laws of ordinary mechanics. And the universe,

constructed on this principle, is a very beautiful and interesting one. It is the privilege of mathematicians to deal with symbols; the physical universe is no more important to them than any other universe which can be developed symbolically. The trouble occurs when the distinction between the real or physical universe and the symbolical or metaphysical universe is obliterated in the minds of men of science.

LOUIS TRENCHARD MORE.

UNIVERSITY OF CINCINNATI.

PURPOSIVENESS IN NATURE AND LIFE.

"Et rien, afin que tout dure,
Ne dure éternellement."
—Malherbe, *La Prise de Marseille.*

AN ordering process amid the ceaseless flow of things has been observed since the beginning of thought about them, and is still the chief material of our anthropomorphisms, gross and refined. We may neglect the flow in our effort to attend to the things, or ignore the things in our overwhelming sense of the flow, but sooner or later the conviction is borne in upon us that nature has some mode of moving or acting, some way of dividing or uniting, which can take none of its wonderful potency from the mere peradventure of chance. How are we to explain the adjustments and adaptations which, in both inorganic and organic, present the world to us as everywhere shot through and through with mind? Why should the universe, like the intellect, segregate and classify, bringing likes together and separating or assimilating unlikes? What is it that matches the rounded boulder with the sphered planet, and shapes the orbits of worlds and the orbits of electrons on the same plan; that relates the spiral of the nebula and of the shell to the volute of the Ionic capital, and these to the curl of the wave as it breaks on the shore; that passes from regularly spaced ether pulses to regularly spaced air waves, sand waves and ocean rollers, to re-appear in the iterated lines of decorative art; that makes one the geometry of the crystal and the geometry

of the honeycomb, the intelligence that moulds the dandelion seed to the wind and the intelligence which builds up human industry, navigates the seas and explores the heavens?

Underlying all anthropomorphism, whether it frankly assimilates nature to man's bodily characteristics, or more subtly reads into it his will and mind, has been the sense that we are in some sort one with the universe and are entitled to fashion it in our own image. But we have selected for our material of interpretation not the deepest and hidden characters of our being, but rather the things most obvious to us as sentient organisms. Our very idea of intelligence is so bound up with conscious and voluntary experiences that these have become for our thinking the *sine qua non,* if not the very essence, of so-called purposiveness. Are our own ends consciously realized? Is human planning inconceivable save as the outcome of consciousness and will? Then all arrangements that suggest contrivance by being directed to end must be similarly determined. Regarding intelligence as constituted of its conspicuous instead of its fundamental characters, we thus commit ourselves to the task of finding will and consciousness in the world at large. Here is the royal and easy road to the elucidation of "design in nature." In this view there can be no purposiveness save as the result of the sentience we associate with mind. But in the deeper insight we are emancipated from so embarrassing a superficiality. Instead of being rounded off by consciousness and will, intelligence is there seen to be the ways in which we act and think, not our awareness of those ways; so purposiveness, whether highly complex, as in organisms, or relatively simple as in the inorganic, is recognized as not primarily feeling, consciousness, or will as such, however closely it may come to be implicated with these, but primarily a mode of motion, a method of change, which has its

roots in the very nature of power. Out of the process thus deeply grounded come the forms that are purposive because they endure, and endure because they are purposive. Change may indeed be the unmaking as well as the making of form, yet nature's richly stored workshop shows us everywhere a final triumph of the ordered over the fortuitous tendencies. The fundamental character of change turns out to be not merely a continuation of the "immobile," but the setting up of form; the fundamental character of form manifests itself not merely as "a snap-shot view of a transition," but as an end or result which is reached and maintained. It is vain to tell us that reality is only the flux of things, and may be summed up as the ceaseless upspringing of something new. What we confront is a vast cosmic drift towards purposive configurations, towards intelligent adaptations, towards symmetry, beauty, harmony, and therefore towards good.

DYNAMIC INTELLIGENCE.

Now the trend towards forms which are purposive because they endure, and endure because they are purposive, is writ large in the visible phenomena around us because it is first writ small, yet all the more potently, in the ground of things. The immediate source of this drift is the so-called conservation of energy, applied as a doctrine in physics to moving bodies; yet maintenance thus conceived is only the more obvious and superficial aspect of a conservation wide and deep as the cosmos itself. Beneath all the vicissitudes which submit themselves to the ordering process is the endurance of that which changes; earlier than motion is the conservation of the things which move and of the ether or power system from which they emerge and with which they are one. If the ether be granular, as there is reason to believe, the universe accessible to knowledge must be envisaged as a unity of dynamic oppo-

sites, of ultimate elements stressing and stressed, each requiring all and all insisting on each. Summated as part contributing to whole, as whole arrayed against part, this insistence on the one by the many emerges as an ever-present and everywhere exercised function of cosmic self-conservation. Before the appearance of matter, maintenance is effected without translatory motion. As likes, holding and held, the power elements are in equilibrium; the antagonism which they exert and to which they are subject is the same for all of them throughout the cosmos. Stresses and re-stresses are everywhere balanced. There is everywhere incoming and outgoing strain kept from change by likeness, and only awaiting difference to manifest itself as motion. And translatory motion begins when, by some modification of the units—possibly by partial coalescence of them into definite groupings—ether gives rise to matter. Were only one material unit formed it would not move, since the stress on it would be the same from every direction. But when many such units are produced, the relation between them and the system which we call gravitative springs up. It is not inconceivable that they shield each other in some way from a total stress which acts on all; but whatever the explanation, we must assume that the pressure inward from without all such bodies is greater than is exerted by the ether system outward from within them. And with the advent of matter and of matter in motion comes the drift towards forms and configurations that endure.

All kinds of motion in the universe may be traced to differential stresses whose goal is equalization, and therefore endurance. Inorganic matter does not move "of its own accord." If the stresses on a body from all directions are equal, it will remain at rest; if it be stressed more from one direction than from all other directions it will move. Set in motion where there is no resistance, it continues to

move, and the energy expended in setting it in motion is conserved for future delivery whenever resistance is encountered. Where motion occurs through a resisting medium or against resisting objects, the initial energy is distributed as motion through the resistances. As the energy of moving bodies is a secondary form of the constitutive cosmic energy, so motion is a secondary form of cosmic self-maintenance, since it secures the continuance, either as kinetic or potential, of the energy expended in producing it. Power is two-sided: the unit of it must everywhere have against it an opposing, but at the same time a supporting universe. So in the realm of motion, there must arise instantaneously or ultimately re-stresses equal in amount to the originating stresses. The universe is a self-complicating and a self-ordering because self-maintaining system: it must develop the differences which are its superficial and temporary character; it must insist on the likenesses, on the two-sidedness, which is its fundamental and enduring character. As motion is a way or means by which differential stresses sooner or later automatically eliminate themselves, all change may be regarded as a procession towards conditions of equalized stress. In this way single bodies under differential stress reach positions of rest by motion through their resisting environment; in this way moving configurations, from atom to solar system, have their differentials automatically equalized and harmonized. Where stresses are not equal, change proceeds until by motion away from the direction of greatest stress towards the direction of least stress the collocations, configurations and forms which endure are set up. Objectively regarded, these are ways or means to endurance, and it is because they realize the end of endurance that they display "intelligent adaptation" character, suggest purposiveness, give rise to the idea of contrivance or plan, seem put together that they may continue. The link be-

tween contrivance by man and purposiveness in nature is thus the link of an underlying process common to both and out of which both arise. Due neither to consciousness nor will, intimately as it may come to be bound up with these, intelligence is fundamentally dynamic, belongs to the inorganic before the advent of life-forms, and as modes of motion directed to end, culminating in maintenance, is rooted in the very nature of power.

TELEOLOGY IN THE ORGANISM.

The same drift towards endurance reappears in the organism, not as totally new, but as fundamentally old. The principle of continuity would alone entitle us to regard the living system as derivatively modelled after the cosmic system from which it emerges. What we find in the transition from inorganic to organic is passage from the non-living material unit which is universe-maintained to the vital aggregate which maintains itself, with the function of conservation complicated, but not obscured, by the peculiar conditions under which matter ascends to protoplasmic rank. The electrons, atoms, molecules of an inorganic body are held in existence by the universe—do not depend for their "properties" on the material aggregate which they unite to form. A molecule of iron remains a molecule of iron however the size of the mass to which it belongs may vary. But in living matter these elementary parts, built up into complex units highly sensitive to the inner environment which all of them form for each, have their functioning and structure determined by the nature and activities of the system as a whole. Made up of interdependent elements, each necessary to all, all insisting on each, the one everywhere contributing, the many everywhere dominating, the organism is committed by its very nature to self-maintenance. The differential stress which ensures motion towards the end of endurance is thus

exerted as the power of the whole; the path of least stress for both unit and system is the direction leading towards activities and structures that secure self-maintenance. That the organism does not merely "hold together," but comes internally and relationally to be motile, results from expenditures of energy for self-maintenance and from the involved need of replenishment from without. Repair of structures metamorphosed or injured flows directly from the impulsion to self-maintenance. Any inroad upon normal completeness brings a tension to bear on the whole system, and the organism finds it easier to relieve that tension by repair than to reaccommodate its whole structure to the changed conditions. It is only a more intense, because organized, form of that strain which is seen in reproduction by means of specialized germ-cells developed to secure endurance threatened by the inevitableness of death.

How is the organism guided to the intelligent adaptations which insure self-maintenance? What gives it the semblance of a series of appliances, machine-like, intelligently contrived, for doing the work of life? How does it come to suggest a subtle arrangement of parts put together for a purpose? Man fashions a tool or machine because he is aware beforehand what shapes or collocations will lead to the desired results. The organism, which works unconsciously, has no such prevision based on experience. Its process must be one of effects achieved from instant to instant. How can it reach end by means adapted to secure end? We find the answer to this question by realizing to ourselves the meaning of that original set of the organic system towards self-maintenance which has been either ignored or naively taken for granted in the theory of natural selection. The "contriver" is neither an inner consciousness obscurely or clearly aware of the right means, nor an outer intelligence working as artificer in

relation to his machine, but the system itself plus the motion process. The "plan" in accordance with which the intelligent adaptations are to unfold is implicit in the organism at the very outset of its career. The system has had organic property imposed upon it—the property of life—and is under impulsion to work only in ways that secure self-maintenance. And the impulsion is not due to a "vital force" mysteriously permeating the organism and urging it to intelligent action. It proceeds from the organic units summated as a whole, the one subordinated, the many dominating, and all making an inner environment for each. It is an internal stress of the system on its parts, a dynamic thrust through which each unit and group of units finds what it must do marked out for it by physical influence passed from unit to unit and exerted upon every unit by its immediate environment of units. In this sense, but in this alone, the determination to self-maintenance and to self-maintaining activities is projected forward, as it were, by the nature of the system, just as, though in a far less complex way, the "affinities" of the atom are projected forward by the nature of the atom. In this sense the easiest path for organisms and organic parts is predetermined. Impelled to self-maintenance, it imposes subfunctions of maintenance on the parts, and these in working, however inadequately at the beginning, are guided by the process which automatically compels change as long as there is differential stress, and automatically ceases to compel it when conditions of equalized stress have been attained. It is out of this impulsion of the whole to self-maintenance, this imposition of vital, end-reaching activities on the parts, and this subjection of system and parts to the motion process, that tissues and organs gradually arise. In their beginnings they work against friction, with much waste of power and failure of efficiency. But the resistances they encounter operate as dif-

ferential stresses, and it is by the impact of these that the adaptations are gradually perfected and acquire "intelligent" because efficient form. As long as there is an attainable economy which is not reached, change goes on by motion away from the direction of greatest stress towards the direction of least stress until the appliance or organ has acquired its efficiency maximum. Intelligent adaptations in the organic realm, given the nature of the organic system as a self-maintainer, are thus products of differential stresses that have automatically eliminated themselves by motion. They are enduring forms just because of this elimination. They are "intelligent" because they are ways by which self-maintenance is secured, and not because of their need of any conscious or psychical element to make them intelligent. Certain ends of the organism come finally to be secured by conscious, voluntary action, but even for these there is the same underlying nature of the system impelling to self-maintenance, and the same resistances to action functioning as moulders of intelligent adaptations. As the time-and-space resistances which oppose themselves to our use of a blunt tool lead to the sharpening of it, so do such resistances work to the perfection of our machines and the facilitation of our enterprises. In organism and universe, then—in the one because in the other—self-maintenance is the function of the system as a whole, and differential stresses, working through motion to set up equalized stresses, determine how self-maintenance shall be achieved. For the narrower view of it the process seems mechanical; in the wider view it is seen to be teleological. Causality and teleology, in other words, belong together. However subject to delays and reversals, the teleology of the cosmos is an elementary anticipation of the more complex and precise teleology of the organism. However disguised by consciousness and will, the teleol-

ogy of the organism does but expand and write large the cosmic drift towards enduring forms.

DYNAMIC MEMORY.

Thus far we have dealt with organic development in its phylogenetic aspect. Let us now consider the ontogeny of the system. Why does endurance necessitate reproduction, and why does self-maintenance show itself in the form of heredity? How does it come about that, in the phenomena of growth, the parent or parents should be imitated, recapitulated, and with such a degree of exactness as to suggest conscious and voluntary mimicry of the past? What if it should turn out that this form of memory is neither conscious nor voluntary, but purely dynamic? For answer to these questions we need to examine the reproductive process at its very origin. For life will be found to begin in the active resistance which the organic system offers, not to diminution, but to increase of its bulk. The first synthesis of protoplasm from inorganic matter brings not only increased complexity of material, but also organization of the elements aggregated. Under the domination of the system, configurations arise in adaptation to it and to one another. As the bulk of the whole goes on augmenting by further aggregation, the adaptation of the unit lags behind the structural character of the system, and this lag, in spite of slow modification, is a continually increasing value. The resulting tension between system and unit, the latter clinging to a structure required in the past, the former requiring a unit structure suited to the present, finally reaches a critical stage, whereupon the system divides into equal parts. By this division, which has many analogues in animal societies, the strain is relieved. But the products of the division do not remain quiescent. The hand of the past is upon them. Another tension, individual and collective, is now theirs—the tension of incompleteness.

Accustomed to a larger system, and made up of units more or less definitely adapted to it, they are now impelled to complete themselves, and to do this in a particular way. The time-and-space order of change with which they have been impressed summons them to the repetition of that order by definite and precise vicissitudes. Under stress from the dominating system, not as existing merely in the present, but as a time-and-space whole, they find it easier to build up the old conditions then to readapt themselves to the new. Continually receiving fresh material from the outer world, they not only mould that material into the accustomed forms, but also impress upon the elements assimilated the power to assist in further assimilation until the original system has been completely reproduced. The objective type or plan of the mature organism to be thus exists in the product of division or reproductive germ as a series of paths of least stress and greatest stress towards which and away from which it must move. Growth is the recapitulation of those experiences of activity and structure which, by interadaptation of the units, the dominating whole has made easiest for all of them. It represents the passing over of differential stresses into equalized stresses, involving changes of form along with changes of place; it is an aspect of end-reaching, the completion of the organism being an end for all the units and for each of them. It is therefore, objectively speaking, a means to self-maintenance.

The phenomena of heredity thus require us to regard the organism not merely as a structure in the present, but also as a process in time. The whole which at any particular instant determines to self-maintenance is at once structure-whole and process-whole. As the unit structures are interadapted and thus come to be insisted on by the system, so are their unit time phases interdependent and interdetermining: they constitute an order of change on

which the dominating system insists. And the method by which the time phases are enforced along with the spatial structures resembles memory just because the underlying process of memory is dynamic, and not in any sense conscious or voluntary. We are enabled to learn by heart because the brain units engaged acquire an order of change to which the whole brain system adapts itself, and on which, because of that adaptation—arraying the many against the one—the brain system insists. The "affinities" of the inorganic atom remain the same, whatever may have been its experiences; the behavior of the organic unit is determined by the experiences of the system to which it belongs. And the recapitulation of them in heredity results, not from the distribution of specialized elements to each area of the organism to be built up, but from the co-operating dynamics of the entire system as a time-and-space whole. The "gemmules" of Darwin, the "micellae" of Nägeli, the "dominants" of Reinke, the "determinants" of Weismann, and the "pangenes" of De Vries, are no more than symbols which look forward to the real explanation. Beneath and beyond them is the determination of the system as part and whole to unfolding and expanding in a particular way. Life is thus cyclical, and death manifestly results from the complexity and interdependence which underlie heredity, and from the heredity that makes insistence on the time-and-space order of change inevitable. The organism is not an object which would go on living for ever were it not attacked, harrassed, and finally worn out by the unceasing onslaught of hostile influences from without. It is a system carried through a cycle of change which, however that cycle may be lengthened, no improvement of the conditions of life will ever enable it to escape. Birth and growth, maturity, old age, death—these are the stages of a time-and-space order on which the dominating system insists, and to which the contributing

units are for ever subordinated. Reproduction is therefore a provision against the inevitableness of death—a means to self-maintenance required by the insistence of the system as time-and-space whole on the organic cycle. The elementary form of death is seen in simple protoplasmic fission; to this is added in the higher organisms the dissolution of the non-reproductive body or soma.

ORGANIC CAUSATION.

The need of envisaging the organism as a dynamic system, for the explanation of which neither vitalism nor mechanism avails, should now be obvious. In dealing with vital phenomena we are really dealing with what may be called organic causation — the determining and guiding power which the living system exerts over its interrelated and cooperating parts. And by the use of this term it is not meant to set up any absolute distinction between kinds of causation. All it involves is the recognition, not of different species, but of varieties of the same species—not of two wholly unlike sorts of the cause-effect relation, but of that relation as it shows itself, on the one hand in the inorganic, on the other when operative under organic conditions. Inorganic causation may almost be said to define itself by virtue of the fact that it is non-organic. The objects to which it gives rise in the pre-vital world exist as objects independently of one another. In the living body, and none the less really though less obviously in the social system, structures and activities reciprocally imply, require, are needed by, and insist upon each other, with the power of the contributing part subordinated to the power of the dominating whole. Facing nature and society, the human individual finds himself in the grip of two forms of control. On the one hand he is dealing with things which have no organic need of each other; on the other

he is dealt with by beings correlated, interdependent, forming a power system from which he receives and to which he must contribute. In inorganic causation we get a multitude of separate incidences no one of which is dependent on the rest. Organic causation is the product of numbers reciprocally involved, contributing yet subordinated, interdependent yet dominated—a power cumulative from unit to system and refluent from whole to part as a power of self-maintenance.

This domination of the one by the many finds elementary exemplification even before the advent of life. The inorganic unit is never indifferent to numbers; everywhere the one undergoes modification, if not change of property, from its association with the many. As part of an aggregate it is armed with the whole inertia of that aggregate; it then offers greater resistance to impact and moves farther than when acted on alone. And the modification begins earlier than with Ruskin's "little flake of mica sand" which rose from the weakness of isolation to be "knitted into a strength as of imperishable iron" as the citizen of a granite kingdom. Lothar Meyer[1] called attention to "the existence of a connection of some kind between the functions of the parts of a molecule and the composition—using this term in the widest sense—of the whole molecule." The action of an aggregate on its parts is well shown when, in the phenomena known as "elastic reaction," a wire which has been recently and frequently twisted develops a "sense of fatigue" that makes its behavior when again twisted different from that shown when it has been a considerable time at rest. If a bar of nickel steel, when put under a drawing strain, hardens that part of the bar which is nearest to the breaking strain, we are compelled to believe that it is the whole aggregate which, if only in an elementary way, resists the threatened rup-

[1] *Die modernen Theorien der Chemie*, pp. 6, 103.

ture. So in the formation of crystal, as Herbert Spencer[2] suggests, "we are entitled to conclude that the crystallization goes on in each part under the control of all the other parts"—that "the entire aggregate of crystals coerces the molecules in each place, while these in turn join all the rest in coercing those in every other place." Then, with a happy thought whose deep-seated implications he does not seem to have perceived, Spencer infers a similar coercive action exerted by the organism as a whole on its parts, remarking as he is about to extend the analogy, "The thing is done, but it is impossible to imagine how it is done." A pertinent suggestion of how it is done for the organism is given in *The Cell in Development and Inheritance,* where (p. 59) Edmund B. Wilson writes: "As far as growth and development are concerned, it has now been clearly demonstrated that only in a limited sense can the cells be regarded as cooperating units. They are rather local centers of a formative power pervading the growing mass as a whole, and the physiological autonomy of the individual cell falls into the background."

The foundation is the same on whatever aspect of the life process we concentrate our attention. Under inorganic causation the molecules have a merely inorganic relation to one another. They act as molecules of carbon, oxygen, nitrogen, phosphorus, sulphur and what not, and the configurations they will assume can be described in purely physical and chemical terms. But when favored by organic conditions they show the results of a new relation. What each of the molecules shall do is henceforth determined by what all of them must do. The single properties of the units, in a word, are transmuted or merged into a collective property, that of life itself. The so-called vital force imagined by an earlier age, the potency missed by the physico-chemical theories of later date, are just this

[2] *Facts and Comments.*

influence exerted by the dominating system over the contributing yet subordinated units, just this power of the all imposing collective character on each, just this superposition of organic property upon inorganic property, just this lifting of matter from simpler forms in which it is universe-maintained into complex forms that are self-maintained. The driving and directing power of life, buttressed in and derived from the pre-vital cosmos, is thus the organism as a whole. Life adds nothing to the store of energy present in any organic system, nor does death abstract in the least from that store. What happens in the one case, while organic conditions prevail, is the imposition of the law of the whole with which the units have to reckon; what happens in the other, when organic conditions finally cease, is the handing over of the system to the more elementary determinations. The difference between inorganic and organic causation cannot be better illustrated than by contrasting the phenomena which characterize a body while it is alive with the processes that go on in it when it has ceased to live.

In place, therefore, of vague assertions that organic activities have intelligent character, reveal the tendency which Von Baer called *Zielstrebigkeit,* or are mysteriously presided over, according to Hans Driesch, by a "psychoid" which directs without exerting any causal action, we get the account of a process due, under organic conditions, to the impelling and guiding force exerted by the organism as a whole over its own parts, and to the nature of motion as a procession away from conditions of greatest stress towards conditions of equalized stress. We also see the so-called perfecting tendency rationalized and explained by reduction of it to dynamic factors. Not only are the organic units urged into efficient and economic configurations by the resistances they meet with in functioning: the entire organism, by its very nature, is under a differential

stress impelling it as part and whole to higher and more perfect means of self-maintenance, the direction of least stress being the direction which leads to completer division of labor, higher specialization of function, improved forms of reproduction, closer cooperation between members of the species, more complex and finer adjustments to environment. When, therefore, the nutritive and general conditions are favorable, the organism ascends in the scale of life, handing down to its offspring such variations as obtain the support and sanction of the species. We must meanwhile assume that if adaptations in the inorganic do not arise capriciously, there can be no ultimate fortuity in plant and animal. If, in spite of counter currents, there is a vast cosmic drift towards intelligent, enduring forms, the organism cannot be helplessly subjected to the unrule of chance. The variations out of which such forms arise in the interest of life, whether minute and gradual, or saltatory, must be held to acquire their ultimate adaptation, their intelligent character, not fortuitously, but through movement towards definite goals pre-figured by the needs of organic self-maintenance, the character of matter, and the nature of the motion process. And though natural selection may powerfully help to conserve what has been won, the winner of the advantage is always the organism itself.

INTELLIGENCE PLUS CONSCIOUSNESS.

Recognition of the nature of intelligence as fundamentally dynamic relieves us from the presumed necessity of everywhere reading "psychic powers" into nature as a means of comprehending intelligent adaptations. Why, then, should some of these adaptations be implicated with consciousness? How does it come about that in the organic we have two sets of end-reaching movements—those of the internal processes which do not involve consciousness,

and those of the relational activities which do? It is here assumed that in the inorganic system, lacking the reciprocality above described, there can be no psychic character, minute or massive. But in the simplest protoplasmic system the interdependent units are subject as whole and as part to the shock of all the changes imposed upon them by environment and arising within them as means to maintenance. It is not merely that the disturbance is diffused —it calls forth a reflex movement of all the units, and it is this reciprocal tremor of all of them jointly implicated and reacting which constitutes the objective side of whatever awareness or feeling the incipient organism has thus far reached. As with advancing organization uniformities of outgoing action come to be set up, uniformities of action from without provided for, feeling will be more and more withdrawn from established orders of change and restricted to variations or departures from such orders. For motions that recur with constancy, for processes that go on with unbroken regularity, there is no shock and no reaction of the system: with the one and the many interadapted to them, the regularities are taken up into the very process of the time-and-space whole. Consciousness remains only for those muscular and mental activities which, falling outside routine, evading organization, cannot become automatic. And even for these, with the gradual splitting up of function and division of work, it comes finally to be located in the brain.

Consciousness is thus of the sudden, the irregular, the unaccustomed. How do the organic activities undergo division into usual and unusual? Here the conception of group actions and reactions will aid us. Each specialized tissue, physiological process and organ has the character of a class, since each arises out of a special set of class determinations. It is because the properties of matter exist in classes, and because the incident forces exist in

classes, that the organism must utilize or react on these for self-maintenance by means of processes and organs that constitute classes. Gravitation is an objective class, and has its organic correlate in organs of locomotion; ether and air-vibrations form classes, and have their complements in organs of vision and hearing. Out of the incoming of repeatedly iterated determinations that are likes to each other, requiring continually iterated outgoing actions of fundamentally like kind, arises each organ and process through which self-maintenance is secured. But while organic class is thus the correlate of objective class, there are degrees of resemblance in the conditions of action, incoming and outgoing. In the lower life the correspondence between organization and activities is close: this is the realm of motions requiring little or no choice, of mechanical responses, of reflex action, of the so-called tropisms and, to a greater or less extent, of instinct. As complexity increases, as the impulsion to self-maintenance demands more precise and varied adjustments to environment, as motion and manipulation grow more selective and discriminating, the organism analyses out the original likeness of conditions into differences, with the result that the organic class comes to be split into actions which can be automatically performed and other actions which must be voluntarily and consciously performed. The change occurs not in the physiological processes, which are relatively constant, but in the muscular and mental activities which relate the organism to its surroundings. Some of these are not accompanied by consciousness for the reason that the determining elements are likes to each other; others must be consciously performed because, though belonging fundamentally to the class, the elements differ superficially from each other and thus need effort to include them within it.

This breaking up of the original holophrasm of the

class may be illustrated from the sense-perceptions. In vision, for example, there can at first be only the vaguest sense of light and shade; in the latest stages we find these analyzed out into multifarious varieties by the class organ, the shade definitized as objects, the light split up into colors. So sound, at first a generalized sensation, comes at last to be broken up into differences, with a specialized appliance in the ear for recognizing each. Now all the varieties thus arising belong fundamentally to their class —that of light or sound—and are therefore dealt with by their class organ. But as varieties they have to be won, as it were, from their superficial difference into coalescence with the group to which they belong. For the higher organisms, to be alive means to be ever moving, manipulating, mentally active—means to be involved in constant changes of relation to environment through a complex of experiences in which no two muscular movements, no two mental adjustments, no two cognitions of objects, or even of the same object, can be exactly alike. The brain is thus meeting situations which are at once fundamentally old and superficially new. The whole of organic ascent is, in fact, a progressive analysis of reality into those variations from the class which demand effort for their inclusion within the class. It is for these variants from an original theme, this doing and perceiving of things superficially new yet fundamentally old, that the organized brain mechanisms do not suffice. For them special connections have to be made between the neurons, fresh paths furrowed for the flow of nervous energy; and in these deviations from the customary, from the usual, from the organized, the whole brain engaged in the effort quivers in response, and there is not only the deed, but also the illumination of it which we call consciousness.

Has consciousness any causative or determining part in organic processes? If we mean by consciousness only

our awareness of what we are doing, the reply is that it has not. If we mean by consciousness the physical correlate of that awareness in brain and nervous system, the answer must be that it is so in-and-in woven into the physical changes from which it arises as to be an inseparable factor of them. Originally the shock to which feeling is due could not have been more than a sort of by-product of the functioning of organic matter in self-maintenance. In the long, slow evolution of life from lower to higher, and finally to highest stages, it must have been gradually interorganized with the rest of the physiological processes. It has thus become an indispensable part of those processes, not in the sense of determining their occurrence, of being their *raison d'être*, but in the sense of helping to make up a whole of interadapted actions all of which require each, each of which is necessary to all, with the result that specific kinds of psychical change are kept inseparably linked with particular sorts of physical change. That the objective shock should appear to us as consciousness remains inexplicable, as is sufficiently shown by the difficulty of describing awareness in other than terms of itself. The illumination we have as conscious is an irreducible fact, set off by its uniqueness of character from all other facts. All we can say of it is that it subsumes in brain and nervous system a highly specialized form of the same reciprocality of power which the universe itself displays. For all grades of feeling there is needed that relation of the implicated one to the including many, that swift interchange between the dominating many and the subordinated one, which are possible only in living matter and within the narrowly delimited areas of organic systems. If on the objective side consciousness is the attitude of the system towards unusual and unorganized changes within it, on the subjective side it is such changes seen in the many-faceted mirror for

which each organic unit, reflecting and reflected, is also at once thing and image of thing to all the organic units.

In consciousness, as in everything else pertaining to life, we thus come back to the organism wielding itself, in possession of itself—to a system arising out of nature, belonging to nature, yet none the less set off from nature by organic causation and the activities of self-maintenance. It is only because our psychical states are conspicuous, the physical states which produce them concealed, that we have been eager to promote consciousness to causal rank over that which originates it; only because the obvious teleology of our voluntary activities, muscular and mental, shuts us out from the teleology of the process which underlies them, that we have clung obstinately to the view which makes consciousness the principle of intelligence and the driving power of life. Little as we can scrutinize the physical correlates of our conscious states, we are bound to assume that all these states without exception, from the simplest feeling of discomfort to the highest flights of abstract thought, are founded in non-psychical processes, and fit these as the cast fits the mould. The set which we have towards life and life's activities is plainly imposed, not primordially by the feelings we have as knowers, but primordially by the physical body we inherit and wield as doers. As the real source of organic teleology is not a psychical principle, but the nature of the organism plus the motion process, so the real guide to intelligent adaptations is not consciousness, but the ends implicit and demanding realization in a system under impulsion to maintain itself. Finding consciousness associated only with some of the organic activities and absent from the whole of the inorganic world, we are compelled to regard it as a peculiar and narrowly delimited aspect of reality, and at the same time a superficial, not a fundamental aspect of life. Finding teleology in both organism and universe,

we are compelled to trace it not to a psychical, but to a dynamic principle. Consciousness suffers nothing by being delivered from the embarrassment of irrational claims. It rises in dignity the more we can view it as the outcome of a process deeper than its own; it becomes more precious to us the more closely we can link it with life; it takes highest rank when, as revealer, it patterns forth, however imperfectly and unsatisfactorily, something of the wonderful resources of the organism and the inexhaustible richness of cosmic power.

CHANGE AND ENDURANCE.

Power is here regarded, not as an aggregated multiplicity, but as a divisionalized unity. Its differentiation into material units makes groupings, collocations, moving systems and configurations of them possible. The impulsion of the cosmic system to self-maintenance, its conversion of differential stresses through motion into equalized stresses, result in the arrangements we call intelligent adaptations. The "end" of maintenance, of endurance, is implicit in the nature of the system, whether inorganic or organic; it finds realization through the displacements and replacements which the system imposes. Contrivance or design in nature is the elementary form of the end-reaching we witness and practise in our own lives as organisms. Out of a process which has endurance for its goal emerges in both living and not-living the intelligence of "intelligent adaptations." In accepting this view we deliver purposiveness in nature from its supposed origin in psychic elements; the notion of a cosmos ruled by mind widens out into the thought of a cosmos potential of mind, as well as of possibilities unutterably beyond the grasp of mind; the appeal to the argument from design yields to the argument from the nature of power. Purposiveness in life is meanwhile emancipated from both vitalistic and

mechanistic assumptions—from the crude symbolism of the one, from the narrow empiricism of the other. The organism is under determination: in all its acting and developing the cause-effect relation may be traced. But as a self-maintainer it is none the less relatively self-centered, self-acting, autonomous. The physico-chemical properties of matter are servants, not masters in the house of life. The determinism is that of a system that wields itself. The freedom involved is that of organic causation.

The cosmic flux, like the organic flux, must be regarded as a means to endurance. Change is eternal, but things flow and continue to flow in the same general way, in modes that can be relied on and predicted: the vicissitudes succeed each other, their order remains. There are plenty of unteleological conflicts in nature, yet the emergence of enduring form—there as suns, planets and their furnishings, here as the crowded display of the organic world—shows beyond peradventure a final triumph of the collectivizing over the dissipating, the purposive over the fortuitous tendencies. As motion in the inorganic ensures the conservation of power, so changes in the organism are means to self-maintenance. The functions of life in the moneron and in man do not essentially differ; the class frameworks remain throughout organic ascent—it is only their content which undergoes multiplication and enrichment. In human activities, in tools and machines, even in social and political systems, men work towards the things which endure. Speech is a body of signs whose general character survives all changes; human thought, through whatsoever vicissitudes and controversies, keeps its fundamental elements unmodified. There is an inertia of mind as well as of matter, a conservation of ideas as well as of energy. The drift of science is towards a body of truths that shall endure; sure foothold in their own affirmations is also the quest of the theologians. The world's

great thinkers still "beacon from the abode where the eternal are."

Insistence on the flow of things is thus only half the story. All material objects are time-and-space wholes: only as such, and as arising out of the cosmic whole, can we have reliable knowledge of them. To sum them up as present existences in time or as local existences in space is to cut them off from the universe. Even if we could isolate the flow from the things that flow, we should need to take account of its direction and end. Only by realizing the flux as teleological, as a working towards intelligent forms, do we grasp the meaning of change, and to that extent the meaning of reality. The changes that seem to expend power do but insure its continuance. The power that changes not survives all change as the very possibility of change. The French poet spoke more wisely than he knew when he declared that "nothing endures eternally, in order that all may endure."

EDMUND NOBLE.

BOSTON, MASS.

DEATH.

O DEATH, in thee we reach life's consummation;
In thee we shall find peace; in thee our worries,
Anxieties and struggles will be past.
Thou art our truest friend! Thou holdest
The anodyne which cureth every ill.

Thou lookest stern, O Death; the living fear thee;
Thy countenance is severe and awe-inspiring,
And creatures shrink from thee as their worst foe.
They know thee not, for they believe that thou
Takest delight in agonies and horrors,
Disease and pain. The host of all these ills
Precedes thee often, but thou brook'st them not.
'Tis life that is replete with suffering,
Not thou, O refuge of the unfortunate,
For thou com'st as surcease of pain; thou grantest
Release from torture, and thy sweetest boon
Is peace eternal. So I call thee friend
And will proclaim thy gift as greatest blessing.

Death is the twin of birth: he blotteth out
The past but to provide for life's renewal.
All life on earth is one continuous flow
Which death and birth cut up in single lives
Of individual existences
So as to keep life ever new and fresh.

Oblivious of the day, that moulded us,
We enter life with virgin expectations;
Traditions are we of parental past,
And gain of our expanding souls we hand
To the succeeding ages which we build.
The lives of predecessors live in us
And we continue in the race to come.
Thus in the Eleusinean Mysteries
A burning torch was passed from hand to hand,
And every hand was needed in the chain
To keep the holy flame aglow—the symbol
Of spirit-life, of higher aspirations.

'Tis not desirable to eke out life
Into eternity, world without end.
Far better 't is to live in fresh renewals,
Far better to remain within time's limits.
Our fate 't is to be born, to act our part
And, whether we approve of it or not,
When all is finished, to depart resigned.
Again and evermore again, life starteth
In each new birth a fresh new consciousness
With wider tasks, new quickened interests,
And with life's worn-out problems all renewed.
But we must work the work while it is day,
For thou, O Death, wilt hush life's turbulence
And then the night will come to stay our work.

When we have tasted of the zests of life,
Have breathed the air of comprehension, have
Enjoyed the pleasures of accomplishment,
When we have felt the glow of happiness,
The thrill of love, of friendship, of endeavor,
When we have borne the day's heat and have sweated
Under the burden of our tasks, we shall,

Wearied of life's long drudgery, be glad
To sink into the arms of sleep, to rest
From all our labors, while our work lives on.
As at the end of day we greet the night,
So we grow tired of duties, pains and joys
And gladly quaff the draught of Lethe's cup.

Wilt thou be kind to me, O Death, then spare me
The time to do my duties and to finish
My lifework ere I die. Let me accomplish
The most important tasks that lie before me,
So when I die I have not lived in vain.
But has my purpose grown beyond myself,
I shall be satisfied and welcome thee.

Kinder thou art than thou appearest, Death!
Peace-bringer, healer of life's malady,
Thou lullest us into unconsciousness.
Thine eye, well do I know it, solves the transient
Into mere dust; but thou discriminatest,
Thou provest all, O just and unbribed judge,
Appli'st the touchstone of eternal worth
And thou preservest the enduring gold.
Thou settest free the slave, soothest all anguish,
Grantest an amnesty for trespasses,
Abolishest responsibilities,
Bringest cessation of the troubles which
Are harassing in life. Thou simply closest
A chapter in time's interesting book,
There to remain as we have written it,
And so thou dost no harm. Happy is he
Who neither feareth nor inviteth thee.

I honor thee, great sanctifier Death,
Lord of the realm of no return—High Priest

Of the unchangeable, thou consecratest
Our souls when gathering them unto their fathers
In their eternal home; I honor thee,
Yet will not seek thee! I am here to live
And will abide until the hour arrive
To enter on my Sabbath eve of life.
But neither shall I shrink from thee, for truly
I see no cause why I should face thee not.
Thou dost not doom me to annihilation,
Thou wipest out my trace of life as little
As any deed can ever be annulled.
Indeed, thou comest to immortalize,
To finish, to complete, to consummate,
To sanctify what I have been and done.
Therefore, I shall be ready at thy call
And deem the common destiny of all
Meet for myself, so when thou beckonest,
Friend Death, grant me thy sweet enduring rest.

EDITOR.

CRITICISMS AND DISCUSSIONS.

A SATIRE ON THE PRINCIPLE OF RELATIVITY.

EDITORIAL INTRODUCTION.

The principle of relativity has been advanced by two physicists, Dr. Albert Einstein, of Zurich, and H. A. Lorentz of Leyden; and by a mathematician, Hermann Minkowski of Göttingen. The two former are still living, but unfortunately Professor Minkowski has died prematurely. Their theories have found much recognition and the number of their admirers in the scientific world of to-day is legion.

The results of the new view are most astounding. The traditional conceptions of science are abolished and the new doctrine that replaces them is so paradoxical as to justify the boldest dreams of the superrational and superscientific fancies of savage and medieval mysticism. The public stand in breathless astonishment and the man of common sense is baffled.

This new movement has been discussed editorially in several articles in *The Monist*,[1] which have recently been collected in book form under the title *The Principle of Relativity in the Light of the Philosophy of Science*, and in these a rather critical attitude is taken toward the bold conclusions which the new school draws from what seems to us a neglect of a proper recognition of the principle of relativity. The present number of *The Monist* contains an article by Professor More of Cincinnati University which criticizes certain details of the theories of the leading relativists, taking them of course quite seriously. But there has now appeared on the scene a Vienna engineer, one Mr. Leo Gilbert, a satirist who pours upon the heads of the inventors of the new physics,

[1] "The Principle of Relativity," April, 1912; "The Philosophy of Relativity," October, 1912; "The Principle of Relativity as a Phase in the Development of Science," July, 1913.

and also upon their most prominent supporters, the vials of his sarcasm in a book which bears the vigorous title *Das Relativitätsprinzip, die jüngste Modenarrheit der Wissenschaft.*[2] He dedicates the book to Mr. Rudolf Goldscheid, joint editor with Prof. Wilhelm Ostwald of the *Monistische Jahrhundert.*

The irony which pervades this little book is certainly of sufficient interest to justify extended extracts which will prove both instructive and amusing. The advocates of the new principle of relativity will say that our author harps too much on the same string, viz., the paradox of inverting time, allowing the future to precede the present and even the past and thereby rendering it possible that an effect may precede its cause. We will even grant that he does not, at least in this book before us, try to do full justice to the intentions of his adversaries; but a satirist has the privilege of a poet and we need not take him over-seriously. Even a greater man than Leo Gilbert, the Attic playwright Aristophanes, plied the whip on the wrong man, on Socrates, when he meant the then modern school of Sophists, the relativists and pragmatists of decadent Athens. So we must forgive Mr. Gilbert for sometimes being too severe, and also for sometimes hitting too hard. The book is thus described in

THE PUBLISHERS' ANNOUNCEMENT.

In the last seven years the principle of relativity has found wide circulation and has gained many adherents. Nevertheless many have also been puzzled by the strange logical contradictions of this new theory which make heavy demands upon their credulity. Philosophers, as in fact all educated people, are perplexed by the fact that absolutely new views of the nature of time are introduced and all previous habits of thought seem to be overthrown. At the same time it must not be forgotten that such new principles are always thought out only by the few and that the majority must be reconciled either against their will or submissively to the views which are thrust upon them by these few. Confident opponents of the principle dare not venture forth, for they are at once repulsed, overwhelmed with scorn or otherwise subjected to unpleasant experiences. But when an entirely new cosmogony is to be constructed then its opponents must be heard first, since they contribute most

[2] Verlag Dr. W. Breitenbach at Brackwede i. W., Germany. The extracts quoted in this review have been translated for *The Monist* by Lydia G. Robinson.

of all to the clarification of the new system of ideas. Therefore an author should be gratefully received who has found the extraordinary courage and love of work carefully to weigh this miracle-working hypothesis of the "relativity of time" and to publish his opposition in a satirical form which is universally intelligible and at the same time affords entertainment. As Leo Gilbert himself says, it grieved him exceedingly that he was compelled to a satirical treatment of the matter by the indolence of the specialists and their skill in killing by silence. In his preceding work on "The Foundations of Exact Science" (*Fundamente des exakten Wissens*), he had shown that it is the seriously constructive, positive work in science which he has at heart. Even in this satire he has not been driven so much towards negation as toward positive results, for the most noticeable thing in his satirical treatment is the fundamental reality which led him to the solution of a problem that has been hanging in the balance for sixty years, namely the Fizeau experiment. Hence we must say that the entertaining form in which Leo Gilbert's polemic is carried on, while providing an important explanation of the doubtful aspects of the principle of relativity, at the same time affords captivating reading—though naturally only in so far as the reader is not too zealous an adherent of the principle of relativity prone to condemn in advance every other view as heretical. However one may feel about the book, in any case it is an interesting document of an intellectual movement and a scientific controversy of our own day.

THE MEANING OF RELATIVITY.

[Leo Gilbert thus complains that relativists neglect to define the term:]

These investigators have neglected first to determine what they wish to understand by "relativity." They have used the innocent word blindly, regardless of consequences. The designation of the new "principle of relativity," which contains not the slightest trace of "relativity," has arisen in the same way. Foolish misuse of words!....

It is an ancient and atrocious evil of science that it uses the same word interchangeably in the most different meanings. Since the mind must each time bring order anew into this chaos, mental operations become difficult and many errors arise. It thus becomes a strict requirement of the economy of thought that these gentlemen should define relativity before they apply it. Nevertheless I can

inform them right now that such a definition is rather difficult and troublesome, for in every relative there lurks an absolute, and in every absolute a relative. Thus in the relativity of Newton, the absolute appears in the guise of the specific zero of the relative. For instance, if only one of the velocities $b, d,$ and e equals zero the absolute values of all the others are at once known to us. Thus, if the sun had the velocity $b = 0$ in space, then the absolute velocities of all our planets would be known. Here I find another fundamental error from which the relativists proceed and which throws light upon their remarkable philosophical comprehension. They think, as Schames expresses it, that nature must remain "faithful" to itself everywhere; but these gentlemen mean by this that nature must remain faithful in every case to their own lack of intelligence.

The fact is they believe that everything, even time itself, must be made relative in the sense of the relativity of space. These scholars have no suspicion that the world and the knowledge of the world rest upon contrasts, that there is an absolute for every relative. If science designates certain features of space as relativity it must still strive to determine (1) what are the limitations of this relativity, (2) where it passes into its opposite, (3) what we must regard as its counterpart, its correlate, the absolute. Doubtless space and time are opposed to each other as the infinitely great arch-integral to the infinitely small arch-differential, as the boundlessly extended to the exactly limited, as the constantly being to the disappearing functional, as the relative to the absolute....

The greatest mistake of the gentlemen is that they ignore a self-evident fact in order to discover a monstrosity.

NEWTON TURNS IN HIS GRAVE.

[The author begins his satire with the following introduction:]

Lately I dreamed of meeting the immortal Newton. "How do you come here?" I asked in astonishment. He answered:

"I am an old gentleman, over two centuries old and quite stiff and lazy; so I would not have thought it possible that I could turn over in my grave with such lightning rapidity, but it gave me a dreadful shock when Professor Sommerfeld of Munich recently declared at a learned congress that the fabulous new principle of relativity of Messrs. Lorentz, Einstein and Minkowski had been well established for six years. I decided to come back to earth at once and find out what was the matter, and how these over-zealous people had supplemented my old theory of relativity by

a wonderful new abracadabra charm. My spirit glided with youthful agility into the body of a professor who is in the habit of looking down upon his colleagues in a high and mighty way. Then I betook myself to a number of famous old scholars of the highest rank who kept outside the crowd, hoping that I might find out something from them. But here I was no less astonished. These geniuses, like all the neutral professors, privat-docents, young freshlings and mathematical dilletantes, all gave me one and the same answer. Whenever I attacked the fiction, its sponsor would defend the 'new ideas' like a lion. He would quote formulas, roots, velocities of light, experiments of Fizeau, Michelson, Morley for perhaps ten minutes at a stretch. Then right in the heat of the debate he would grow strangely lukewarm, would become lame in the hips and finally creep off into an impenetrable thicket of brambles, saying: 'Oh I have not been able to enter into the matter in such detail, I only tell what I have read. But still there seems to be something deep in it; that may be taken for granted. Just think of the Kantian ideality of space and time and how it is again confirmed here!' Hardly would the lion have uttered the word 'Kant,' of whose meaning of course he had barely the remotest suspicion, when he would again become a ravenous beast in his safe bramble thicket snarling at me and showing his teeth."

"What the Devil's the use of being 'specialists,'" cried Newton greatly excited, "when they have 'only read,' when they have not even taken the trouble to study carefully these wonderfully fascinating 'problems' and 'new discoveries'? Why are they blind believers in miracles, idly boasting of Kant's ideality without knowing what it is? And yet they pretend to be men of exact science! Are they not ashamed of their intellectual beggary and vagueness?"....

When I awoke and the master had disappeared, I reflected upon my dream and thought of the many friends who apply to me, mostly philosophers and naturalists who are "not mathematicians," people who in their guileless honesty believe that the sacred image of Sais is hidden behind the tomfoolery of formulas in whose brambles the originators of the "new principle" are hopelessly lost. They ask: "Can you not explain to me what there really is in it? It must be very magnificent!" Now, my dear inquiring friends, I will tell you!

TWISTED LOGIC.

The logic with which these gentlemen treat science will be best illumined by the mental lightning which Professor Einstein permits to flash on us only "incidentally," quite aside from the other fundamental attainments of his nimble intellect. He carries out a calculation with his formulas of relativity and goes on to say:[3] "This result signifies that we must regard as possible a transmissive mechanism by means of which the anticipated effect precedes the cause (perhaps accompanied by an act of will). Although in my opinion this result in a purely logical sense contains no contradiction, nevertheless it is so absolutely opposed to the character of our entire experience that through it...."

Isn't that great! The very top notch of freedom from prejudice! According to Professor Einstein no logical contradiction is involved when the effect takes place *before* the cause, hence when, so to speak, the effect acts as the cause of the cause, in which case then the cause would appear as the effect of the effect. How droll! And why not? Let us illustrate: The farmer's wife finds an egg in the stable. In a week she will go to market and buy the hen that is to lay the egg she has already found. Who can object to this? Einstein agrees with it.

An oak has been cut down; a chauffeur and three passengers of an auto lie with broken heads by the side of the road. Afterwards, however, it occurs to the chauffeur to put on the highest speed and rush against the oak, lose his presence of mind and let go the steering wheel. The coroner of course held the inquest over the four bodies two weeks before the accident, and three years previously they were buried—the effect before the cause.

We also admire the education attained by a good old man whose parents are only just born—all of which Professor Einstein would find quite "natural."

These are the same gentlemen who have been so busily and fashionably engaged with entropy, and who when it comes to the point, do not even know that their "entropy" means that every occurrence has a direction in time.

These gentlemen fire before they load, post up laws of nature before they discover them and place knowledge in their head when

[3] In the *Annalen der Physik*, edited by Wien and Planck, Leipsic, 1907, Vol. XXIII, pp. 381-382, in the article "On the Inertia of Energy Demanded by the Principle of Relativity."

they have no head. Nothing is impossible for the true scholar—*den echten Gelehrten, den verkehrten, unerhörten, überquerten, reingeleerten—quasi geistesgestörten.*

Einstein may be a distinguished scholar in the matter of figures and formulas, but when it comes to the philosophy of nature and the theory of cognition he is without any doubt an eminently useless man, a genius of illogic. And the rest are no better.

Equally wonderful is Prof. H. A. Lorentz's theory of electricity. According to his view matter consists of matter—of course worthless dead matter—but with electrons added to it. Nature takes electrons and attaches them to simple motionless matter. ("Synthetikon glues, sticks, cements everything: one tube only twenty pfennigs!") Now if we tickle both matter and electrons, matter alone will suffer it patiently. The electrons however become excited, and then they are electrical. On the other hand, if matter is given a velocity it no longer remains indifferent; it straightway changes the unchangeable, its mass! For a long time Lorentz proposed that it only changed its length, but then other insisted that it changed its mass. In the world of "these" physicists who are also called "new," everything is conceivable. Where guns kill before they go off and go off before they are loaded, "mass" can easily be sweated out through the pores of matter. This is not at all surprising in a physics according to which the electrons break their way, or "stream," through a massive copper wire with a velocity of 300,000 kilometers.

Why? How? By what means do electrons cling to matter? What is the use of matter if it is inactive? What is the deeper connection, the real significance of these things? What is the sense of "mass" if mass be changeable and if it can disappear? How can the law of conservation suddenly be surrendered? What after all is the meaning of this "new" physics which denotes an absurdity radically lacking in system, a ridiculous tomfoolery?

What is mass after all?

Just consider the grand unitary world-conception, so actual, so sensible, so beautiful and unbroken which the grand old thinkers have built up, men like Faraday, Hertz, Mach, Ernst Haeckel and others, and compare with it this crazy, giddy, confused whimsicality. It presses the wine before the grapes ripen and cuts the grapes before they are grown; before men drink they stagger and reel in drunkenness and folly.

HOLES IN THE ETHER.

Every year about ten thousand professors of high schools, universities, technical institutes, and also some independent scholars devise about ten thousand queer hypotheses of which they themselves are the only fanatical adherents.

Perhaps ten or twenty of them find a dozen blindly faithful believers among their boon companions at the tavern. One will whisper to another with lifted brows: "O that Bookmiller, he has a head on him! The world will hear from him yet. He has proved positively that if a camel be only large enough it can go through the eye of a needle! He has proved it by higher mathematics!"

Higher mathematics! That chokes off every contradiction! A few out of the hundreds of thousands are more successful. They find believers by the help of a high-sounding name. This was the case a hundred years ago with phlogiston, and fifty years ago with the world's entropy-end and with countless other jokes. Such is the case to-day with the "new" principle of relativity. According to it the largest camels have actually passed through the tiniest needle's eye of this principle. It is the eternal victory of banality operating with "higher mathematics"....

Poincaré, whose calling as a mathematician is not attacked here, in his lecture on "The New Mechanics" arrives at this remarkable decision: "We can almost say that there is no longer matter but only holes in the ether, and in so far as these holes seem to play an active part it consists in the inability of these holes to change their location without influencing the surrounding ether which exerts a reactive influence on such changes."

This entire statement is fabulous, yea insane, and might pass in a sanitarium for incurables. Fabulous is the typical academic caution with which the famous mathematician expresses himself. He does not say, "Thus it is and not otherwise." He only says, "We may *almost* say." Nothing rises up within him against the paradox that holes play an "active" part. He does not perceive in the least that just this thing we can not say, not even "almost." He expresses himself very cautiously with professorial diplomacy: "in so far as these holes 'seem' to play an active part." What genuinely scholarly delicacy: "seem"! We can assure M. Poincaré with absolute certainty that this time appearances are most lamen-

tably deceptive; that holes can disclose no activity; that they lack all fitness to evoke any sort of "reaction." We could assure M. Poincaré, the famous mathematician, (if he were still alive) that by holes is understood the opposite of anything that can parade as energy or as capacity for work. By "holes" the human intellect has always understood and will continue to understand the unsubstantial, the unenergetic....

When certain gentlemen speak of "nature philosophy" they remind me of the Italian "nature singers," who certainly do not understand singing and do not even possess voices; but that is exactly what they call nature.

THE ELEMENT OF MYSTERY IN THE "NEW RELATIVITY."

First of all we shall try to make the nature of this "fact" comprehensible to the popular mind by a comparison.

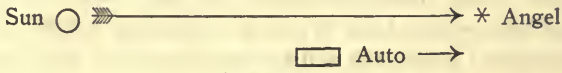

Fig. 1.

Let us imagine an angel flying away from the sun with the velocity of $c = 300{,}000$ kilometers per second. If we stand on the sun we can observe that the angel is moving away from us a distance of 300,000 kilometers every second. This is his velocity with reference to us as inhabitants of the sun.

Let us now place a chauffeur in an automobile which starts from the sun at the same time and rushes along by the side of the angel with a velocity of $a = 299{,}999$ kilometers. Then the angel will gain only one kilometer over the auto in a second. The angel moves away from the chauffeur only one kilometer each second. Hence with respect to the chaffeur the angel possesses a velocity of only one kilometer per second. This is clear and positive.

Now what would we think of a man who came along and said: "No that is not right. Instead, the fact is that there continues to be a difference of velocity of 300,000 kilometers between the angel and the auto. No matter what the velocity of the auto, the angel precedes it always 300,000 kilometers more every second; for instance 3,000,000 kilometers in ten seconds. In other words, no matter how rapidly the chauffeur may be moving, the velocity of the angel with reference to him is exactly as great as it is for the stationary inhabitants of the sun." Would we not judge that such a

man was not quite normal in the upper story, or think with Goethe that

> "A contradiction absolute
> Is always for the wise, no less than fools, a mystery"?

A COMMON-SENSE EXPLANATION OF THE PRINCIPLE.

Before we enter upon a critique of the principle of relativity, we shall here present in brief outlines what it really signifies. It treats of the motion of bodies in space, and of the velocity of transmission of rays of light. And indeed we observe the motion of bodies which travel equal distances in equal times and which therefore possess so-called "translatory" velocity. We assume with the relativists that the ray of light is transmitted in an absolutely stationary medium, in cosmic ether or in empty space, hence independently of the motion of any kind of body.

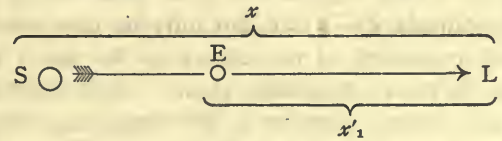

Fig. 2.

At first glance the matter seems supremely simple. Let S represent the sun. Let S——L be a ray of light that travels through empty space with a velocity of $c = 300{,}000$ kilometers per second. Let E be the earth which, as we arbitrarily assume, moves with a velocity of $a = 100{,}000$ kilometers in the direction of the arrow. Every one can now say: If we stand on the earth and measure the velocity of the ray of light it is only E——L $= c - a = 300{,}000 - 100{,}000 = 200{,}000$ kilometers ahead of the earth at the end of one second. In other words, the more rapidly the earth moves, the smaller is the difference between the two velocities. If the earth were to dash through the universe as rapidly as the ray of light, then the latter would possess no difference in velocity with reference to the earth; i. e., they would both arrive at the same time. The ray of light would possess a velocity of 0 with reference to the earth. This is what would be expected clearly and unequivocally from the standpoint of common sense. But this is the point where the relativists violate logic and replace the sensible conclusion by a very different one. They say: Whatever may be the velocity a of the earth, the ray of light will always outdistance it by $c =$

300,000 kilometers. If the earth stands still the ray of light will have a velocity of 300,000 kilometers measured from the earth. But if the earth moves at the rate of 100,000 kilometers still the light ray will exceed it every second at the rate of 300,000 kilometers. This is Einstein's famous "principle of the constant velocity of light."

The reader sees at once that this last assertion is impossible. Its conclusion is contradictory to logic if, as above assumed, we accept the hypothesis of the relativists according to which a ray of light is entirely independent and is supposed to move independently in an ideally conceived empty, absolutely stationary cosmic space. In this space the ray of light could have a velocity only $c - a = 200{,}000$ kilometers greater than that of the earth. Hence the view of the relativists contains a fallacy. They would have the relative velocity of light with respect to the earth $c - a = c$, however great a may be, and this is an impossibility. On the basis of their hypothesis, $c - a = c$ can only be true when $a = 0$; i. e., if the earth remained as motionless as the sun. How the relativists come to their remarkable claim will be discussed elsewhere. Here we will merely mention briefly that they lean upon an experiment made by Michelson and Morley. From this they think they may deduce that the ray of light always possesses the same velocity of transmission of 300,000 kilometers with respect to the earth, no matter with what velocity and in what direction the earth may move.

This conclusion they call "the fact" which is identical with their "principle of the constancy of the velocity of light." Upon this "fact" they erect the principle of relativity. The principle of the constant velocity of light may be expressed very generally as follows:

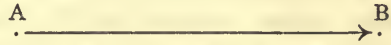

Fig. 3.

Let A be a body from which a ray of light proceeds and B another body which receives the light, e. g., a mirror or the eye of an observer. Then this principle will mean that the velocity of transmission of light with respect to A and also to B always possesses the same value c no matter what the velocity of each of these bodies.

THE MICHELSON EXPERIMENT.

Whenever one speaks about the principle of relativity to serious estimable people, minds of the first rank, they reply: "To be sure I haven't dug into this principle very deeply as yet, but there must be something in it. There is a fact at the bottom of this principle. Michelson has performed an experiment that...."

Fact? My head swims! Have we then come to this after a century of exact research that we talk about "facts" like bad lawyers? Some bewigged head peeps through a telescope and sees a black elephant whirling around between Jupiter and Saturn. Hence it is a "fact" that black elephants fly back and forth between the planets! What! Do you doubt it? Still, it is a fact! Professor Valerian Eyeblinker saw it himself in the observatory! Unobjectionable!

What is the real fact about this "fact"? Only that Mr. Valerian has seen something black! Whether it is an elephant, or whether it moved among the constellations, or whether it was a fly in the telescope, or a *mouche volante* in his own eye, is no longer a fact but the interpretation of a fact.

Of course there are no "facts" but only phenomena and their interpretation. For instance it has always been a "fact" that the earth turned around its axis and around the sun, but for thousands of years the phenomenon was given the interpretation that at night the sun slipped under the earth in a stove-pipe and hid there until it came out again in the morning to wander across the firmament. When Galilei and Kepler found other interpretations people would not believe at first that they were right. For thousands of years every one had been able to see the sun rise in the morning, even children; it was a "fact." And yet it was not a fact. Then what is a fact?

To the relativists the ray of light constitutes an object of "fact." Since by its nature this is just as unknown as the angels of religious myths, anything can be invented about it that one wishes.

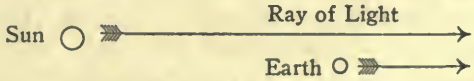

Fig. 4.

Hence, a ray of light moves away from the sun at the rate of 300,000 kilometers a second. According to the statement of the

astronomers the earth possesses a velocity with respect to the sun of barely 30 kilometers a second, hence $\frac{1}{10000}$ of that of light. If the relativists' hypothesis is correct, that the ray moves independently in a stationary vacuous cosmic space, then we must regard the velocity of light with respect to the earth in the direction of the earth's motion as $c - a = 299{,}970$. In the direction perpendicular to this there would be no subtraction. The ray would retain its $c = 300{,}000$ kilometers per second. Therefore it must be confirmed practically by experiment whether a ray of light in the direction of the earth's motion shows a lesser velocity than a ray perpendicular to this direction.

Michelson has performed a corresponding experiment with a ray from a lamp and has found that a ray of light in the direction of the earth's motion by no means remains 30 kilometers behind a ray perpendicular to this direction, but that both rays travel equal distances in equal times....

Thus the result of Michelson's experiment is—as Hertz has long surmised—very simple and a matter of course. The ray of light depends only on the atmosphere through which it moves. It is an undulation of the atmosphere.

THE FOUR RELATIVIST POSTULATES.

An intelligent and versatile author, Herr Fritz Müller, published an excellent popular presentation of the principle of relativity entitled "Der Zeitgeist," in the *Berliner Tageblatt* of October 16, 1911, following upon a lecture of Professor Einstein in Zurich. In order to facilitate the reader's insight into this subject, we here quote his expositions. The comments do not come from Herr Müller but originate with the present author.

A short time ago Professor Einstein gave a lecture on the relativity of time before the society of naturalists in Zurich. When he had finished, a wave of excitement passed over the learned heads. A fallacy had been pointed out, a fallacy as old as humanity itself. For hundreds of thousands of years the apparent experiences of our organs have deceived us into thinking that there is an absolute time in cosmic space. Both the child and the critical scholar believed it, but the assertion is false. Einstein, on the basis of the preliminary studies of other physicists, has corrected it and found that there is no such thing as absolute time. Time is dependent on motion in space.

I know that at first sight this statement does not arouse interest.

It leaves the layman as cool to-day, as did the discovery that the earth turned around the sun, and not the sun around the earth, in Galilei's time. Galilei was an intellectual revolutionist when he exposed an optical illusion and deduced the inexorable consequences which created anew for mankind the image of the universe. Einstein exposed a fallacy in the conception of time, and what are the consequences as regards our world-conception? Here they are:

1. There is no rigid time. Time shrinks together with motion in space.

2. There are no rigid bodies. Their forms flow with motion in space.

3. Space and time are interchangeable.

4. There is no ether.

The principle of relativity is decisive for these remarkable results. What is relativity? The fact that there is nothing absolute in the universe. Every condition depends upon another. Taken mentally, philosophically, this has been clear to us for a long time.... That velocity in space and that time as the content of consciousness are relative is a truism, but the physicist stretches his notion of the term "relative" still farther.

VELOCITY EATS TIME.

Suppose two clocks keeping the same time to have each an observer and to stand side by side. Now suppose one of them with its observer suddenly rushes out into space with the velocity of light. The two observers have previously agreed to telegraph the time every second by means of a light signal. Men have no other medium but light by which to communicate with each other about the simultaneousness of two occurrences in different places. Further let us bear in mind that the criterion of simultaneousness is that the passage of the ray of light should take as long in one direction as in the other. Is this the case with the two clocks when they stand side by side? Obviously yes. And if one clock is traveling with the velocity of light? Obviously no; for the stationary observer, it is true, receives at regular intervals of one second the stipulated light signal from the other, but the latter does not receive any from the former. Whenever the stationary observer wishes to signal his time to the moving observer—whether in a fraction of a second after the start, or one, two or three seconds after—he is never able to do so, and the other one waits in vain for a signal. The signal behind the moving observer will never, never in all

eternity, overtake him if he travel with the same velocity as the signal itself. Hence the criterion is wrong. After one, after two, after three seconds the clocks would show a difference of one, two or three seconds. But in the judgment of the stationary observer this would indicate that the moving clock would be just that much too slow. In our extreme case in which the journey is made with the swiftness of light the stationary observer would believe that the other clock would not arrive in time at all; that there time would stand still. The Einstein equations actually arrive at this result. The same is true, Einstein says, of the observer traveling with the clock, namely, that in the opinion of the stationary one he would never grow old. "And what if he return to his point of departure on a broken line?" somebody asked the lecturer in the discussion. "Then in our judgment he would remain as young as when he started," answered Einstein in all seriousness, "even if we who remain behind had in the meantime become gray-haired; the equations furnish for every direction of motion, even for motion in a broken line, the same results without variation." We look at each other. That sounds fabulous. Fabulous? Certainly, the old fables of the monk of Heisterbach, of Rip van Winkle, of Urashima Taro come to our minds. It is strange how popular imagination has taken the same direction with the Germans, the Americans and the Japanese—all three tales concern people whose life stands still for many years, while those around them age. Thus at their return they find another land and a different generation.

"And if we imagine," another one objects, "that there was some sort of an effect which could be transmitted along a cord, we will say, with a velocity greater than that of light?" "Then it would have to be possible," answered the lecturer, "to devise a mechanism by means of which an effect could be produced upon the past." "And the result would be?" "Merely that this idea is so contrary to our experience that we are compelled to reject it until the opposite is proved. Hence we must assume on the basis of our previous experience that a velocity exceeding that of light is impossible, that it is absurd." Again the hearers are reminded of something, this time it is the remarkable novel *The Time Machine* by the Englishman Wells, who a dozen years ago made his engineer hero construct a machine by means of which he could set himself back into the past. In a remarkable anticipation of future research that poet speaks of time as of a fourth dimension which is of equal validity with our ordinary three dimensions of space, indeed is

even interchangeable with them. Nevertheless the mathematician Minkowski, building upon Einstein's foundation, comes also to the conclusion that physical occurrences are represented in a four-dimensional space in which time plays the same rôle as the three physical dimensions. Further Minkowski concludes: "From this hour space-in-itself and time-in-itself are to disappear entirely into shadows and only a sort of union of the two will retain independence, for no one has observed a place except at some time, or a time except in some place." And time? It may be entirely or partly replaced, extinguished by motion. That which we call time will be wholly compensated by a motion which proceeds with the velocity of light. A body traveling in space with the velocity of light will, from our point of view, be forever timeless. Hence, space is time and time is space. To put it strongly, motion eats time.

[A strange proposition! If a motion equals the velocity of light which is our means of communicating the time of a distant clock to us, time disappears and so we learn that velocity eats the time. Time is annihilated.]

TIME OVERTAKEN BY VELOCITY.

Let us consider a case which may also be found in somewhat altered form in the work of Camille Flammarion.

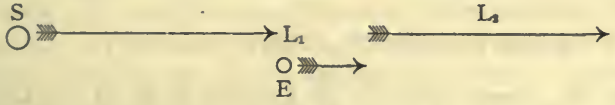

Fig. 5.

Let us imagine the earth E traveling before the sun with a velocity greater than that of light. Then the rays L_1 which come afterwards will never reach it but will always be farther and farther behind. We shall not see the sun any more at our left. But yesterday and the day before yesterday, and many hundred years before that, rays L_2 have been emanating from the sun which have already proceeded far ahead in cosmic space. The earth now travels into this ocean of rays and catches up with all of them in succession, since it of course travels faster than a ray. What will happen now? Our eyes will be pierced successively by the rays of light which the sun sent forth yesterday, ten years ago, one hundred years ago. Hence we will obtain pictures from the sun's past in earlier and earlier years, will observe its life and

development inversely, will witness the sun-child as boy, as baby, as an infant in swaddling clothes, until the sun is decomposed into the rotating masses of vapor from which it has originated. We would witness the entire process of the sun's growth in an inverse direction....

Our eyes travel with the earth along the rays L_2. Hence these rays reach our retina from the right and we shall no longer see the sun on our left, for in that direction it has disappeared from our view. From this time we shall perceive its reflection only from the right, accordingly in the direction opposite to that in which it really is....

These mystifications, these optical illusions in the observation of things were known to us long before the relativists. The relativists attempted merely to adopt this idea, but they have corrupted it instead by dragging their formulas into it, in consequence of which the visions here described count for them as "facts." In the case just described, in which according to the old conception we would have to look back into the past of the sun, all values even become imaginary; that is to say, we lose the ground of reality entirely from under our feet. The physical experiment becomes an absurdity. Even the course of our clock becomes imaginary, yes, even time *in propria persona,* space, all processes, our organism, mankind,—in short the disease becomes incurable.

OBJECTS SHORTENED BY VELOCITY.

When the famous physicist of Leyden, Prof. H. A. Lorentz, advanced his incredible formula for an impossible behavior of light towards moving bodies, reality got beyond his control. But since his was a genuine Faust nature, it was easy enough for him to construct a handful of brilliant new laws of nature. The mathematical genius of Leyden created a "new" law for himself and a "new" world. Boldly and prudently he advanced a proposition which contradicts the law of inertia so laboriously attained: *Bodies which move through space with a velocity are diminished in the direction of their velocity,* computed only in the direction of their motion. What a phenomenal labor it required to diminish an earthly body, for instance bars of porphyry and steel, only $\frac{1}{200000}$ of its length, Lorentz did not take into consideration. He worked a charm contrary to the dictum of all renowned conjurers who must know better, namely, that legerdemain is not magic.

That such a shortening—it is called after its gifted originator a Lorentz-contraction—nevertheless must obviously possess a most profound energetic significance, that it operates in its consequences upon the surrounding universe to the most remote stars, that it must transform our entire world-conception—these points the master has wisely passed over in silence.

To be sure this wonderful law would be of great practical value. For instance it would no longer be necessary to send fat people to Marienbad to partake of its bubbling waters and to torment themselves with constitutionals by the hour. They would need simply to stand daily for an hour at a time with their bodies in the direction of the earth's motion. Because of the earth's velocity their bodies must needs experience Lorentz-contractions and become thinner, and this by means of the power of the beneficent new laws of nature.

Yes, let us say it with ruthless plainness. We must not let the earth too greatly exceed its alleged velocity of 30 kilometers, nor must we allow her ever so to forget herself as to assume a velocity of 300,000 kilometers, for then it would be all over with us. The Lorentz-contractions would no longer be child's play. We would become quite flat. Indeed flat is no name for it! No, we would be infinitely thinner than flat; for since the dimension of the earth would contract to nothing—absolutely nothing—in the direction of its motion, then in this extreme case it would become only a circular disk like the paper hoops which the circus clown holds before the leaping equestrienne on her dapple gray horse. Only this hoop would be infinitely superior in strength to the flattened earth, for it is of the tangible thickness of paper, whereas the thickness of the earth would be 0, nothing. All dimensions of the earth in other directions would remain the same in their original extension. Hence it would have merely a circumference, it would be a flat disk without thickness, a bodiless body, a breath! A scheme, a concept! So much can a planet be reduced when it assumes velocities which approach the velocity of light—and when at the same time it falls into the hands of famous mathematicians....

But what if the velocity of the earth exceeded even that of light? If it traveled at a rate of 350,000 or 400,000 kilometers per second, which of course might actually be so, though if it were we would not be able to find it out. Would it then have a minus thickness? What would a minus thickness look like? No, according to the formula it attains an *imaginary* thickness, but it always

continues to be *really* broad, high and round; only in its thickness, (i. e., in the direction of the motion) is it *imaginary*.

That would indeed be a sublime thought! By spinning out this idea I could, if I thought it necessary, obtain not only the friendship but also the admiration of the relativity physicists who are to-day in the lead. They would erect bronze monuments to me while still in the flesh.

[However, there are some differences of opinion. Leo Gilbert continues in the next chapter, saying that everything is mere appearance. He says:]

The fat men have congratulated themselves too soon. Unfortunately the Lorentz-contractions are ineffective. For, sorry to say, Prof. K. A. Einstein in Zurich, the most thoughtful of the mathematical prestidigitators, has deprived us of this new benefaction, and so has rescued Marienbad from desolation. Let no one who stands with his body in the direction of the earth's velocity be persuaded that it really is reduced. The reduction is only apparent. But in appearance, in imagination, the phenomenon positively takes place!

MINKOWSKI ON TIME.

[Formerly we thought that time is absolute in the sense that the present moment is everywhere. It is the ever-present Now which is in the same way here and there, on earth, on the sun, on the star Sirius and on the most distant sun in the universe. But Minkowski teaches us something better and grander; he says time is relative. Mr. Gilbert continues:]

It is asking altogether too much of the ordinary human intellect, but there can no longer be any doubt about it,—now is no longer now, day before yesterday is no longer day before yesterday. But yesterday is to-morrow, the future is past, and to-day is nevermore! The relativity of time! Delightful word! Intoxicating term! If it only had some sense! The late Hermann Minkowski is said to have been a very eminent, some say from hearsay an "ingenious," mathematician. This is sufficient to account for the high respect which his colleagues render to a talent in which Minkowski was absolutely lacking, namely the interpretation of natural phenomena. He lacked every suggestion of a trace of ability to touch creatively the philosophy of nature or the theory of cognition. A professor of mechanics in a technical high school in Germany once recommended to me the ingenious lecture of Minkowski on

time and space, and added, "which unfortunately is hard to understand." A funny recommendation of something which can not be easily understood, hence may even be false. I believe indeed that the lecture is obscure enough for many professors of mathematics, and it is only from this haziness that we can understand that the gentlemen of the eightieth congress of naturalists at Cologne dissolved in admiration before the splendid intellect of Minkowski. The uncomprehended has always been the greatest religious mystery before which mankind has bowed. If you wish to be successful be obscure, be unintelligible. Especially for naturalists! particularly for exact scientists! and most of all for mathematicians!....

I at once wrote back in reply to the excellent professor of mechanics that unfortunately the lecture was only too intelligible to me since I had been engaged on the subject for twenty years, and that I had perceived nothing in it more clearly than a certain childish guilelessness with which Minkowski had passed by the little that had already been said about time and space by better thinkers....

[If he had studied into the matter] it would have been impossible for him to have combined all the fabulous absurdities which could find comprehension in that wonderfully constructed brain, in which a medley of numbers, physics and Kant, dance around in confusion.... Minkowski tells us: "From now on space-in-itself and time-in-itself sink entirely into shadows and only a sort of union of the two can retain independent existence." Of course this childish poetry about the "sinking shadows" which brings to mind school memories of Homer and Dante is wonderfully affecting to the hearts of mathematical physicists, so that many hasten to quote this remarkable phrase of "a sort of union" in their publications.

Moreover Minkowski has made the most surprising discovery that time is not the same time everywhere. We poor inferior people had hitherto believed that the present moment which we now experience on earth is identical with the present moment in the most remote finitenesses. In short, that time is absolute, rigorously absolute, as rigorous as the most rigid of all the laws of nature.

Oh, fudge! Minkowski and Einstein now inform us that even time is relative. When our clock upon the earth strikes twelve, on another star in another system of planets it may be striking three quarters of an hour and five seconds after twenty-six, or even thirteen hundred and seven. The simultaneousness of events, that

powerful controlling law which alone makes possible a thought, a comparison, a demonstration, a knowledge—the law of the absolute simultaneousness of the infinitely small differential of the moment which divides the past from the future by a hair, and which we call the present—this iron law of reason is simply abolished by an overrational professor in the midst of the acclamations of other professors.

"No hour strikes for the happy man"—especially at the beer table of the naturalist congress when the gentlemen have done joyful justice to the enlightening beverage....

In their liberality with senseless contentions the relativists are downright spendthrifts. One reads in Minkowski the subtle clairvoyant assertion that there are several cosmic spaces. "Several cosmic spaces!" This remarkable mode of thought and speech has already found its quotation fiends, for there is no folly which does not arouse some scholar, or author, or journalist, by the fascination which lurks in paradoxes, to dish up the affair scalding hot. "Several cosmic spaces!!!" How very amusing!! What can separate them from each other? Cardboard walls? Or strong leaded glass? Probably plate glass, because otherwise the ray of light upon which the whole relativity bluff is based could not shine through from one cosmic space to the other. Or perhaps the partition walls are made of thickened ether? Or baked electricity? Or dried formulas and watered scholars' prattle?

Among the people who have fallen into the trap of the Messrs. Relativists with particular *élan* and *chic* is to be mentioned Geheimrat Dr. Max Planck, professor at the University of Berlin. In an essay which appeared in the *Umschau* of October 29, 1910, and which bore the pompous title, "The Position of Modern Physics with Relation to Phenomenal Nature," even he quotes admiringly Minkowski's bold phrase [with reference to time and space] about the shadows and the union. He finds that the principle of relativity leads "to a very far-reaching—one might almost say revolutionary—consequence with reference to the conception of time," "since a proposition with regard to time does not contain a physical sense until the observer's state of velocity to which it refers is taken into account...."

Referring to Minkowski, Planck closes: "Accordingly the physical world accessible to our observations possesses four equally justified interchangeable dimensions, three of which we call space and the fourth, time."

EDITORIAL CONCLUSION.

Much may be said in reply to Mr. Leo Gilbert's satire; how here and there he slightly twists the propositions of the inventors of the principle of relativity, and how in his exuberant humor he draws consequences which they would not countenance; indeed some of them are actually disavowed. Relativists will probably remind him that according to their claim the velocity of light is the greatest possible velocity, which would cut out some of the best and most humorous comments he makes. Yet we must grant him that no valid reason for this assertion of a truly absolutistic nature has as yet been produced. We feel tempted to make further comments as to what may be said in favor of the new doctrine of the principle of relativity and the half-truths it contains, but we prefer to give the relativists an opportunity to take the stand themselves, although they will probably meet this new attack with complaints that they have been misunderstood and that it is not worth their while to given an answer. To kill with silence (or as the Germans say *Totschweigen*) is the safest mode of defence for a weak cause. Mr. Gilbert claims that this is invariably the method of the relativists, and so for his motto he places on the title page of his book the conjugation of the verb, which he calls the "chorus of the craft":

"Ich schweige tot,
Du schweigst tot,
Er schweigt tot,
Wir schweigen tot,
Ihr schweigt tot,
Sie schweigen tot."

In brief we do not endorse all the conclusions of Mr. Gilbert's criticisms, but we deem his book worth a perusal and a careful reply. The mere humor of it will richly repay the reader for the hour spent thereon. P. C.

EDUARD STUDY'S REALISTIC WORLD-CONCEPTION.

Eduard Study, professor of mathematics in Bonn, has published an essay on "The Realistic World-Conception and the Theory of Space."[1] The task before him is thus formulated on page 62:

"In what consists the epistemological value of the geometrical

[1] *Die realistische Weltansicht und die Lehre vom Raume.* Brunswick. F. Vieweg & Sohn, 1914.

systems comprised under 'non-Euclidean geometry'? May we regard them as hypotheses of equal or approximately equal value with the Euclidean in respect to the structure of our space? And if so, may we content ourselves with these hypotheses, or shall we not be obliged to make other cautious attempts to approximate the unknown reality, or rather the image of this reality? And is the path of natural science indeed the only one which can procure for us at least some sort of explanation of this natural geometry? Yea, is it indeed a practicable route?"

Our author mainly follows Helmholtz, and by "natural geometry" we must understand the results of natural science, especially physics, and the results of these investigations concerning space-relations.

Professor Study proposes four theories of space: 1*a*, spherical geometry; 1*b*, elliptic geometry; 2, pseudo-spherical geometry; and 3, Euclidean geometry which may also be called parabolic geometry. As his conclusion he makes four propositions (pp. 111-112):

"1. However natural geometry may be constructed, no distinction can be made, or only with great difficulty, between it and any other of the four designated kinds of measurement-geometry (*Massgeometrie*) by the aid of our present expedients.

"2. The four kinds of geometry above mentioned are to be preferred among all conceivable hypotheses.

"3. The Euclidean in turn is preliminarily to be preferred among these four hypotheses, and it will continue to be valid where the distances concerned are not too great.

"4. It would be rash to regard as settled the epistemological question of the structure of empirical space.

"By means of their at least very close relation to experience, all four kinds of geometry now possess a particular interest among the infinite multiplicity of geometrical systems which the fancy of mathematicians, 'the mathematical play-instinct,' may contrive. It may be convenient to have one word in common for these four particularly important geometrical systems. We take the liberty to interepret a term coined by Helmholtz in this sense: we shall call the above-mentioned four systems of three-dimensional geometry 'systems of physical geometry,' *cum grano salis* in the systems of abstract geometry applicable to physics."

The book contains incidentally many thoughtful remarks, and is mainly useful for its critical observations, especially of Poincaré's views and also those of Mach. We here quote in translation a few

passages on positivism and pragmatism as of special interest (pp. 41-51):

"Indeed the positivists have done an excellent work. What mathematician or physicist would not have derived the richest instruction from Mach's *Mechanics*,[2] that splendid book which cannot be studied carefully and frequently enough, which at each perusal exerts anew its stimulating and refreshing influence! But there is very little in it which a thoughtful realist might not also have said or subscribed to.

"But the 'principle' with which alone we here have to do is criticism and nothing but criticism, pure and indeed downright barren negation, a kind of guillotine or a Procrustean bed which is always too short. The history of philosophy says that it was originally an act of liberation from the excesses of a wild speculation. Perhaps, but why then the exaggeration? To-day we miss in the management of this mechanism the very spirit in whose name it accomplishes, or tries to accomplish, its destructive activity, the spirit of criticism. The 'anti-metaphysical' and 'anti-dogmatic tendency' has itself become an unruly dogma; 'philosophical decrees' are set in opposition to philosophical decrees. It seems to be a universal law that no idea is safe from unlimited exaggeration. Witchcraft, belief in ghosts, spiritism, fourth dimension of space, latticed molecules, ions and electrons, generally speaking matter in the usual sense of the word, apriorism, causality, energies, chemical theories, and I know not how many more—this quite varied company is mercilessly put to death and disappears in the same wholesale grave which is destined for metaphysics and its whole witches' sabbath of near and distant relatives as an unadorned tomb. Death levels all. By its side stands the preacher of positivism who has been ordained for such occasions, and he delivers a funeral sermon which though not exactly pious still is certainly imposing. To the assembled mourners and curious spectators—we had almost said guests—he brings the comforting and exalting message that they are witnesses of an event of cosmic importance. In this moment is dawning a new epoch of civilization, the molecular, etc., superstition is destroyed, the beautiful era of science free from hypotheses and an energetic 'culturology' has begun. Then all go home to the accompaniment of music. One man who stands somewhat aside allowed his thoughts to roam. Liberty,

[2] English translation by T. J. MacCormack. Chicago, Open Court Publishing Company.

equality, and fraternity came to his mind, and scenes and faces awoke memories within him. It had happened not long before, and it had been almost as beautiful as now. All the more important 'riddles of the universe' had been solved, and at that time they had buried spirit which had become superfluous together with its own witches' sabbath. Some of the personages now being buried were then cruelly slaughtered and lowered in the grave, of course in their character as the offspring of spirit. And then also had dawned a new cycle of civilization stretching on into eternity, the era of a loftier materialistic civilization. How rapidly the civilizations replace each other even to-day! That is progress indeed! And already another funeral train is approaching with the escort of a corresponding civilization, and in the distance another and behind that still another. Pragmatism, activism, intuitionism, or however else the newest mysticism of the *élan vital* may be called, are drawing near, X-ism, Y-ism, Ism, Ism, Ism! Experts even prophesy that Hegelianism will arise once more. At any rate it is a joy to live! Who would trouble his head over questions which so rapidly lose all attraction....

"We shall now taste of the sweetest newly-ripened fruit of the tree of knowledge, pragmatism. As early as in Mach we find 'the principle of the economy of thought' repeatedly mentioned. This is at bottom the old practical demand—universally recognized, for instance in mathematics—that the results of science be presented as simply as possible. This is now made into a main principle of cognition and the foundation of all science. Hypotheses which as such must be rejected by the positivists are justified by its aid. It really contains a sound kernel, for the cases have been many from time immemorial where the decision between corresponding hypotheses in the natural sciences has been so made that the simpler was given the preference. But the establishment of the theory that the simplest hypotheses are always the best has turned out so inadequately with Mach that one of his opponents proposed the formulation: It saves thought to assume that the thought which saves thought is the correct one....

"The critical point of the affair is apparent in a more general application which Mach has already given to the same thought. It is biologically advantageous (for the profit of humanity) to make the simplest hypotheses....

"The American and English pragmatists Dewey, James and F. C. S. Schiller have developed this conclusion derived from the

theory of biological advantage into the form of a so-called theory of truth. We can notice here, and not unjustly, a terminological misuse. The above mentioned authors might equally well deny the existence of truth altogether. However, on what it depends and what particularly concerns us here is the assertion of the subjective character of all scientific criteria whether or not they are called the criteria of truth: and thus far pragmatism is really a consequence of the theory of biological advantage, and indeed its necessary consequence, if this theory can be said to have any comprehensible meaning at all.

"According to James the individual must balance pleasure and pain against each other, and in so doing he attains a conception of truth, or a criterion of truth (for between the two there is no distinction in pragmatism) and this criterion is valid for himself and is binding on no other person.

"As James himself says, the theories of other pragmatists though differing somewhat in form are essentially in agreement on this point....

"Truth, according to Dewey, is 'that which gives satisfaction' which is obviously a very pleasant conception of truth....

"According to the third representative of pragmatism, F. C. S. Schiller, 'that which works' (following James) is true. By this bewilderingly simple formula the old problem is definitely solved; the 'childish fancy' that there can be a truth independent of ourselves is set aside. But what works to-day does not need to work to-morrow. (*Acqua passata non macina più*). 'An idea is true so long as belief in it is useful for our life' (James). Hence we have here the biological advantage as a utility for 'our' life and at the same time the correct insight that the scientific criteria deducible from it (the so-called criteria of truth) must vary according to time and circumstances. Truths, or what the pragmatist calls truths, come, continue and pass like living creatures; the truths themselves, not our knowledge of a (realistic) truth. But since the pragmatist recognizes and allows only his own conception of truth we must rejoice that, for instance, the Pythagorean proposition still seems to some extent to be useful, otherwise we ought to abolish it on the spot!

"Thus 'does pragmatism loosen all our theories. It has indeed no prejudices, no dogmas that block the way, no strict canon for the demonstrative force of arguments.' It does not 'cling' to logic, and therefore (if we are permitted still to draw logical conclusions)

on proper occasions goodnaturedly would let two and two be equal to five. Therefore 'it possesses a great advantage in the religious domain.'

"This 'thoroughly joyous philosophy' commends itself particularly to large circles of people from the fact that it 'extends the realm in which man can seek God,' and that it is 'democratic.' Indeed it seems to have been copied from the form of government of the United States: a philosophy of the people, for the people, by the people. Let every one come and join....

"To be sure it has already been known that the ideals of the old world culture are 'childish fancy' and that the hitherto so-called science which paid no heed to utility can for the most part be thrown on the rubbish heap. But that such a gospel could be proclaimed on this side of the Atlantic (Europe) is a new idea and a particularly painful one.

"It is conceivable that such things need not be said twice to the 'pragmatically so successful' daily press, especially in the land of unlimited possibilities. Who will doubt that a theory of truth which dispenses on demand, not only milk, butter and cheese but 'religious consolation' as well, would not awaken interest and applause everywhere, even among the laity? Even Herr Ostwald who is inspired by pragmatism (as might be expected) reports how stirringly the lectures of James have affected the whole(?) of intellectual New York....

"To be sure, that the 'bread-and-butter standpoint' corresponds exactly to pragmatistic principles, the pragmatists are not at all aware. James even speaks of shameless slander. By our citations we have placed the reader in a position to judge for himself.... No, the cause of pragmatism's ill luck lies in pragmatism itself, in its principle, and in the jelly-like consistency of its jelly-fish philosophy which dissolves under close scrutiny.

"Pragmatism, which appeals to every one, ought to take account also of the dark side of human nature. This theory which pretends to be a philosophy of life must pay particular heed to its probable effects, to its own 'pragmatic results.' Is there any horrible deed which could not be and has not been proved to be 'pragmatically successful?' Not only people of low 'ideals,' but a conquistador or high inquisitor might have appealed to the pragmatic principles if he had the good fortune to have lived at a time when this philosophy was in existence. 'Nothing is true and everything is allowable.' This is the device which pragmatism ought to choose if it

would keep its consequences in sight. But the pragmatist does not possess a mirror, and, more than that, like the goddess of justice he has a bandage on his eyes. Who can be blamed for not taking seriously philosophers whose wisdom (*inter alia*), is equivalent to saying that there are as many and more kinds of 'science' than there are religious sects!

"Still if a critique regardless of consequences is desired, we need only to be reminded that in every-day life there are also uncomfortable and even quite dreadful truths, truths which are none the less truths for all that; granite truths which can neither be shaken nor interpreted away, and against which all pragmatic balances and dialectic feats are powerless."

The strength of the author lies apparently in his critical powers. His positive suggestions will probably not be considered as helpful, yet the book is suggestive and pleasant reading throughout. P. C.

RECENT PERIODICALS.

The number of *Scientia* (*Rivista di Scienza*) for September, 1913, begins with an article by Aldo Mieli on the theory of substances with the pre-Socratic—this would be better described as pre-Aristotelian—Greeks. The first part, which is here published, contains an examination of those theories which were intended to explain the unceasing transformations of substances in nature, from the earliest speculations to Empedocles and including him. At the time of Empedocles's appearance, the problem was: all transformations being deceptive appearances of the senses, to seek what is true and stable behind all these false appearances. The solution of the problem, curiously enough, is obtained for the greater part by the adoption of a doctrine which had failed in geometry, the doctrine of the Pythagoreans (as Paul Tannery and others have shown) that geometrical figures are sums of points. This doctrine was partly destroyed by the discovery of incommensurable lengths and completely by the "triumphant" reasoning of Zeno. Future Greek mathematicians built up their splendid edifice of geometry on new and more secure foundations, but the fundamental conception of the theory of composition out of points passed into the theory of the composition of bodies. Three directions then presented themselves: (1) Empedocles's theory, which admitted of a limited number of primitive substances that are invariables and, by their mix-

ture, make very different substances appear; (2) the theory of Anaxagoras, which considered all the different substances as existing from the beginning and independently of one another, and made the appearance of that which predominates depend on phenomena of association and dissociation of similar elements; (3) the theory of Leucippus and Democritus, which postulated one and one only original element and explained the various aspects which it presents by supposing that the particles or "atoms" of it are susceptible of receiving different forms or having different relative positions. The fact is emphasized, as Burnet has done in his *Early Greek Philosophy,* that these theories are connected with Paramenides's idea of the invariability of the true "being": atoms were the "being" of Parmenides. The doctrine of Empedocles is examined here in some detail. It was the one most generally adopted by the ancients, by the philosophers of the middle ages, and even by the theoretical chemistry of the nineteenth century. The article is followed by another in the next number (see below) of *Scientia,* and the whole question will be discussed more fully in the first part of a forthcoming book on the general history of scientific thought.

Thomas Moreux, in an article discussing the question as to where our sun is dragging us, gives a useful sketch of the development of researches on the proper motion of the fixed stars from the earliest times up to quite modern ones. A. J. Herbertson has a geographical essay on "The Higher Units," the theme of which is to prove that "regional leviathans" ("if the geographical region is a macro-organism, then men are its nerve-cells") exist and that we each are a part of one.

Eugenio Rignano presents the second part of his studies on the evolution of reasoning, which is concerned with the progress from intuition to deduction. In the first part of this article, the author has said that parallel to, and in consequence of, the passage from concrete forms to forms more and more abstract, reasoning acquires an increasing and more extensive capacity of application, which, starting from quite simple intuitions, carries it to the most complicated deductive processes of science. It is with this aspect of the evolution of reasoning that this part is concerned. A further article dealing with the higher forms of reasoning is promised.

Sigmund Freud deals with the interest of psycho-analysis for psychology. Psycho-analysis is a medical method which tries to cure certain forms of nervous disease (*Neurosen*) by psychological

technic. This article explains, by a series of examples, what the author has claimed, in a book published in 1910, for the new science.

H. Jacobi, in an article with a title asking what Sanskrit is, studies the importance and the position of Sanskrit in the evolution of language and Indian civilization. S. Jankelevitch has a critical note on the thinking horses of Elberfeld. In the department of prehistoric ethnology, Sigmund Feist gives a general review on the question of the country where the Indo-Europeans originated. There are reviews of books and periodicals, a chronicle of events in the scientific world, and a supplement containing French translations of the German, English, and Italian articles.

The first article in the number of *Scientia* for November, 1913, is the second and final part of Aldo Mieli's account of the theories of substances with the pre-Socratic Greeks. In the first part, he had shown that the early doctrines were suddenly abandoned, and three currents of thought—represented by Empedocles, Anaxagoras and Democritus and the other atomists, respectively—were formed. This part deals with the two last currents. It is very interesting to see that the doctrine of Anaxagoras, which has been quite misunderstood until of late years, is capable of taking, when developed, a quasi-modern form (see the author's article in *Isis*, November, 1913; cf. the notice below).

J. C. Kapteyn, of the University of Groningen, writes an article in English "On the Structure of the Universe," in which he considers the questions as to what the discovery of what is known as "star-streaming" has done and what it promises to do for the solution of the problems of (1) the distances of the stars from one another in the line of sight; (2) the history, that is, the evolution, of the stellar system. "It has been my aim," says the author, "to show *not* that much has been done, but that there is a beginning: *not* that we have entered far into the promised land...., but that a few pathways are being mapped out, along which we may direct a hopeful attack."

Werner Mecklenburg shows how the theory of electrolytic solutions affords an example of how two currents of investigation, which seemed quite independent of one another (Pfeffer, Raoult), were united in a higher synthesis (Van't Hoff).

Sigmund Freud, in the second part of an article continued from the preceding number of *Scientia*, deals with the interest of psycho-analysis for the non-psychological sciences, comprising the sciences of language, philosophy, biology, the history of evolution,

the history of civilization, the fine arts, sociology, and pedagogy. Charles Guignebert, in the first part of an article on the dogma of the Trinity, discusses the primitive triads and the baptismal formula, and shows, on a particular example, how the fundamental beliefs of a religion originate, develop, are fixed, weaken, and die. A. van Gennep has a critical note on the lacunae of modern ethnography.

There are two general reviews: one a biological one by H. Piéron on the evolution of modern scientific opinion on the question of mimicry; and the other by W. Oualid, which is an annual review of economy. There are the usual book reviews, review of reviews, chronicle, and supplement containing French translations of the German, Italian, and English articles.

* * *

The second number of *Isis* appeared in August, 1913, and began with a short note by the editor (George Sarton) on the aim of *Isis*. *Isis* is the only review in which the methodological, sociological, and philosophical points of view are associated with the purely historical point of view; this association is effected because it is only by making all these points of view and all these methods converge that historical researches acquire their full signification. Still, history, though an indispensable instrument, is a means and not an end: the end is the philosophy of the sciences. David Eugene Smith, owing to the fact that we have recently come into possession of a quantity of new material, is able to give, in an interesting article on "The Geometry of the Hindus," a presentation of some of the salient features of the Hindu geometry more clearly than has heretofore been done. Antonio Favaro has a short article on the *Carmen de ponderibus* of Guarino Veronese. There are three articles dealing with genius and heredity: one in German by Wilhelm Ostwald, one in English by W. C. D. and C. D. Whetham, and one in French by George Sarton. The second is on "Three English Men of Science"—Newton, Darwin, and Kelvin, and contains the rather surprising statement: "To each one of these men, either continuously or at some period of his existence, religion and not science seemed the end that was best worth pursuing." The third is to be continued, and is on the question of how to increase the intellectual efficiency of humanity. The present instalment contains an introduction and sections on scientific genius and genius and the race. The rest of the number is devoted to a useful chronicle of events and undertakings, analyses of books and articles, and a

continuation of the admirable bibliography of recent works on the history of all the sciences.

The third number of *Isis* appeared in November, 1913, and contains seven articles, three in Italian, two in German, one in French, and one in English. Antonio Favaro writes on the well-known mathematician Niccolo Tartaglia (1499-1557) and the printing of some of his works, particularly the *Travagliata Inventione.* Julius Ruska writes on mineralogy in Arabic literature. Icilio Guareschi writes on Ascania Sobrero (1812-1888), the discoverer of nitro-glycerine, the centenary of whose birth took place last October. Agnes Arber discusses the botanical philosophy of Guy de la Brosse, who died in 1641, and was the founder and first superintendent of the Jardin des plantes of Paris. Aldo Mieli writes on the development and utilization by modern chemistry of the ancient theory of the transformation of substances of Anaxagoras, as distinguished from those of Empedocles and of the atomists. Ernst Bloch studies the ancient atomic theory in the modern history of chemistry. Finally, the editor, George Sarton, continues his article on how to increase the intellectual efficiency of humanity; the present instalment contains discussions of heredity, the inheritance of intellectual aptitudes, and environment and heredity. There is a portrait of Denis Diderot, the bi-centenary of whose birth took place last October. Various notes and reviews of books are given, and the valuable bibliography of works on the history of all the sciences is continued.

The number of *Isis* for February, 1914, concludes the first volume of this new and very interesting periodical. The editor, George Sarton, writes on the present tendencies of the history of mathematics, and begins by distinguishing between what may be called the pure historians and those—philosophers, pedagogues, or sociologists—whose aim is to *utilize* the history of mathematics for other ends. The object of the review *Isis* is that of the latter class. Then the author proceeds to discuss Léon Brunschvicg's *Les étapes de la philosophie mathématique* and Pierre Boutroux's *Principes de l'analyse mathématique,* both of which are analyzed at great length by Emile Turrière later on in the number. Though the author is very well-disposed towards both books, he finds himself obliged to conclude that neither of them realizes a complete historical and critical synthesis of mathematics. Ernst Bloch has a long and valuable article on chemical theories with Descartes and the Cartesians, and the article deals principally with Descartes,

Mayow, Lémery, Guillaume Homberg, Johann Bernoulli, Steven Blankaart, and Georg Ernst Stahl. Then follows Gino Loria's stimulating address to the International Congress of Historical Studies at London in 1913 on the mathematical glories of Great Britain—Bede, Alcuin, Abelard of Bath, Roger Bacon, John Peckham, John Holywood, Thomas Bradwardine, Richard of Wallingford, John Maudith, Cuthbert Tonstall, James Gregory, Robert Recorde, William Oughtred, John Napier, Thomas Harriot, Henry Briggs, Henry Savile, Isaac Barrow, John Wallis, Lord Brouncker, John Caswell, William Neil, Christopher Wren, Kenelm Digby, John Pell, Isaac Newton, John Craig, James Stirling, Patrick Murdoch, Abraham de Moivre, Roger Cotes, Brook Taylor, Edmund Halley, Robert Simson, Samuel Horsley, William Wales, Colin Maclaurin, William Braikenridge, Edward Waring, John Wilson, James Ivory, and many names of more modern mathematicians. There are rather many mistakes in spelling, but the list is otherwise strikingly accurate. Waldemar Deonna writes on Jacques Goffarel, a precursor of the present theory of the origins of art. Philip E. B. Jourdain has a long and rather technical article on "The Origin of Cauchy's Conceptions of a Definite Integral and of the Continuity of a Function," in which the part played by Fourier is emphasized. There are various notes and reviews, a continuation of the admirable bibliography of all the publications relating to the history and organization of science, and an index to the first volume. We hope to see many more volumes of a periodical which shows a worthy carrying out of a lofty ideal. Φ

VOL. XXIV. JULY, 1914 NO. 3

THE MONIST

TRAGEDY AND THE ENJOYMENT OF IT.

HOW is it that we can take a refined pleasure in the mimic representation of scenes that would make us faint with horror if we saw them off the stage? What is the psychological basis and the ancient history of this curious phenomenon?

If you go to Aristotle, as men have been doing for more than two thousand years, with the question, What is tragedy? you will find him basing his famous definition on a highly-developed art-form, the early stages of which were largely hidden from him and are almost entirely hidden from us. Aristotle thought that tragedy, like other kinds of poetry, depended on two fundamental propensities of human nature, namely, the love of imitation and the love of "harmony" (we should rather say rhythm). But we of to-day, who have learned to operate in imagination with a long lapse of ages during which the *genus homo* was slowly acquiring the characters we find him fitted out with when we first make his acquaintance in historical records,—we of to-day are not at all certain that the love of imitation and the love of rhythm are primitive instincts of human nature. Very certainly they are less primitive than, say, the instinct of self-preservation or the instinct of reproduction. Nevertheless, our modern study of savages and of childhood, in which race experience to some extent repeats itself, makes it quite certain that the love of imitation, with a concomitant pleasure in the successful-

ness of the imitation, is a universal and a very ancient development. Somewhat later, one may guess, came the love of rhythm, which seems to have grown out of the primitive dance. I use the word "dance," for lack of a better, to cover any sort of common activity in which a number of persons move their bodies or their limbs together and try to keep time with one another.[1] But while the love of rhythm would seem to be a comparatively late acquisition, it is nevertheless very ancient and well-nigh universal.

But is rhythm essential to tragedy? For Aristotle it certainly was. A tragic drama in prose would have been for him a contradiction in terms—much like an opera without music for us. We, however, are very familiar with the idea of tragedies in prose, albeit we recognize that the greatest tragedies have always been written in verse. It must be said, then, that from our point of view measured language is not altogether essential to the notion of tragedy. On the other hand, for us as for Aristotle, no tragedy is thinkable as a form of art without imitation.

What, then, is the real essence of the thing? If we take Aristotle's celebrated definition and omit what he says about measured language, and if we also omit a qualifying clause which merely affirms something about which there is no room for debate, namely, that the imitation must take the form of action rather than narrative,—we have the following remainder (I quote from Butcher's

[1] In his new book on Euripides, page 227, Prof. Gilbert Murray speaks thus of the primitive dance: "The ancient dance was not, like our ballets, rooted in sexual emotion. It was religious: it was a form of prayer. It consisted in the use of the whole body, every limb and every muscle, to express somehow that overflow of emotion for which a man has no words. And primitive man had less command of words than we have. When the men were away on the warpath, the women prayed for them with all their bodies. They danced for the men's safe return. When the tribe's land was parched for lack of rain the tribesmen danced for the rain to come. The dance did not necessarily imply movement. It might consist in simply maintaining the same rigid attitude, as when Moses held out his arms during the battle with the Amalekites, or Ahure in the Egyptian story waited kneeling and fasting for Nefrekepta's return."

well-known translation of the *Poetics,* Chapter 6): "Tragedy, then, is an imitation of an action that is serious, complete, and of a certain magnitude. . . . through pity and fear effecting the proper purgation of these emotions."

In the main this language is perfectly clear. A tragedy —so Aristotle thought—must be "serious," provocative of grave thought and feeling. It must have "a certain magnitude," that is, it must not be too brief, and it must not be trivial. Again, it must be "complete"; that is, it must have a beginning, a middle and an end, and the end must be a real finality, so far as the principal personage is concerned. Finally, the purpose of the imitation is to arouse the emotions of "pity" and "fear" and to effect the "purgation" of these emotions. Just exactly what Aristotle meant by his far-famed *kátharsis,* or purgation, is a very stale moot-question, which fortunately does not need to be considered here. I have dwelt a little on Aristotle's formula simply that I might bring out this fact: That in the earliest type of tragedy known to us—one, moreover, which has had great influence on modern developments—the essence of the art consisted in the *formal enactment of suffering and calamity.* This would appear to be the simplest, most fundamental account of the matter at which it is possible to arrive.

But if tragedy in its ultimate essence is the enactment of suffering and calamity, then the question arises, How is it that we can take pleasure at all in painful representations? This *crux* has had, on the whole, rather too little attention from the esthetic philosophers. Schiller indeed saw its importance at the very beginning of his studies in esthetic theory and dealt with the subject in a paper entitled *Ueber den Grund des Vergnügens an tragischen Gegenständen,* that is, the basis of our pleasure in tragic themes. But Schiller, here as in his other philosophic writings, presupposes a highly developed humanity. He

has in mind an audience imbued with something of his own ethical idealism; possessed by a feeling for moral heroism, for noble and sublime conduct, for the beauty of self-sacrifice. It is, however, indubitable that the human propensity to find pleasure in painful representations is not a product of advanced culture and has little to do with moral philosophy. It is something far older and more fundamental. It is, in fact, an inheritance from a very remote past, when our forbears took pleasure not only in the fictitious enactment of suffering, but also in the actual infliction of it before their face and eyes. Our problem is one of primitive psychology, in other words, of anthropology; and it is from the anthropologists that we get our best light on the subject. This was recognized by Wilhelm Scherer, when he wrote his *Poetik*—a book which is full of good things about the beginnings of poetry.

Scherer thought that poetry in its first rude beginnings was always a manifestation of joy. He came to the conclusion that it originated partly in the natural expression of pleasant emotions—dance and song having evolved out of leaping, shouting and wooing—and partly in the anticipatory and therefore symbolic performance of pleasant acts. A species of primitive poetry would thus be represented for us, according to this view, by the small boy riding a stick and so anticipating the future pleasure of equestrianship; or by the little girl playing with her doll and so anticipating the coming delight of motherhood. The youngsters know very well that the cane is not a horse, and the bag of sawdust not a baby; but they delight in the exercise of the imagination and in the symbolic performance of the acts which strengthen their pleasant self-deception and make it plausible. Scherer was further of the opinion that poetry, having thus become permanently associated with pleasant feelings and pleasant actions, came to be employed, by transference, in the expression of feelings

and the representation of actions which were in themselves unpleasant, but became pleasant by association. He discusses at some length the ways and means by which this *might* have happened; enough to say that it is very acute and suggestive. I doubt, however, whether Scherer is right in his chronology. It seems to me on the whole more probable that from the beginning, that is, as far back as there was any poetry at all, or any acting of symbolic scenes the paradox of pleasure in pain was already an every-day affair. To be sure, the words pleasure and pain, as used in this connection, do not exactly hit the mark, since pain is apt to suggest something from which one must necessarily shrink. But there is a kind of pleasure which consists in the mere putting forth of energy, in the mere exercise of the faculties. Such exercise seems to be a part of that instinctive love of life which is a biologic necessity and the fundamental law of our being; for a race that did not love life and dread death would long ago have become extinct. But what is it to live? Physically it is to move, psychically it is to feel, imagine and think—feeling and imagination being the more fundamental. Not without reason do we say of a person who has never felt much and has no imagination that he has never truly lived. Just as the child has a certain pleasure in moving, in using its muscles and its voice, so it has pleasure in exercising the psychic functions; in feeling strongly and expressing its feeling, in satisfying curiosity and imagining and representing that which is not. Now in seeking this pleasure which consists in the mere putting forth of pyschic energy we by no means go in search of the so-called pleasant things. On the contrary, we are apt to prefer things that are painful, gruesome, dangerous; for these give the greater shock, that is, the more of that emotional excitement which is life. We

are too apt to think of pleasure and pain as if they were distinct, antipodal and mutually exclusive.

Do I seem to be straying into the blue mists? Let me elucidate the matter with an illustration which at any rate shall not be misty. Imagine yourself at a baseball game. A man is running home from third base. At the distance of ten feet from the plate he hurls himself headlong to the ground, slides in on his belly, and touches the plate just as the ball reaches the hands of the catcher, which are too high to reach him. The runner gets up with face bleeding, with his mouth full of sand and gravel, and with his wrist badly sprained. Is it pleasure or pain? That depends on the point of view. To an elderly and inert philosopher in the grand-stand it will probably seem a very good example of pain. To the kid watching the game from the bleachers it will be an epitome of all that is glorious in life. As for the runner himself, the experience will probably take on for the moment a mixed aspect; but after a day or two, especially if his run has won the game and filled the newspapers with his renown, it will become an altogether pleasurable memory.

In our boyish sports we by no means prefer to occupy our imaginations with things sweet and nice—with candy and pop and Sunday-school rewards of merit; instead of that we like to provide ourselves with make-believe deadly weapons to shoot and kill one another, or we fight with savage beasts and ferocious men. A little girl, playing with her doll, may let the doll die, and may then celebrate its funeral, if she happen to have seen one, taking a solemn delight in providing satisfactory obsequies. Of such illustrations there is no end. One might also adduce the universal interest taken in gruesome ghost-stories and tales of horror, or the fascination of brutal sports, accidents, executions, morgues, battles, and so forth.

Now for our remote forbears, as death was the great

disaster, the supreme object of dread, so it was the most powerful of magnets for the imagination. That emotional excitement which was life was to be had pre-eminently in thinking about death; in dwelling mentally on the dangers that might lead up to it, the heroism of defying it, the rewards that might follow it. We must suppose too that such exercise of the imaginative faculty made for alertness and resourcefulness in time of danger, and so contributed to the sum total of life-preserving agency. A race imaginatively indifferent to death would have stood but a poor chance in the ancient battle of life.

Such I believe to be the general anthropologic basis of our interest in tragic themes. It is of course mainly a matter of speculation. We can really *know* nothing about it, because such glimmerings of fact as we get, on which to base an opinion, are as it were of the day before yesterday. Fifty thousand years ago, for aught we know, there may have been mimicry, accompanied by song and dance and words. If so, there were the elements of drama. But nothing shows conclusively that gay elements preceded the grave, or that solemn mimicry is younger than mirthful. We do not know how many millenniums may have swept by before the rustic festival of the Attic wine-god Dionysus developed, in a favored corner of the earth, into that stately and impressive art-form that we call Greek tragedy.

The early stages of the evolution are known to us but dimly. At the end of autumn, when the wine was first tasted, the so-called rural Dionysia were held throughout Attica. The favorite sport was the *askólia,* which consisted in dancing on one leg on greased bags of inflated goatskin. "There were singing processions of the tribesmen to the altars of the god, where goats were sacrificed."[2]

[2] Quoted from G. C. W. Warr, *The Oresteia of Æschylus,* page xx. Sir Gilbert Murray, in the fascinating book on Euripides previously referred to, page 179, thus describes what he calls the "ancient rite" of Dionysus: "The dæmon

The song itself, at first a wild orgiastic affair, with the singers half or wholly drunk, was called a "dithyramb." In the course of time singers were masked as "satyrs," that is, they wore goat-skins and tails; *satyroi* being the name of the ancient goat-like demons of the field and forest, who were thought of as belonging to the household of Dionysus. Thus the dithyramb acquired the name of *tragōdia,* or goat-song. Presently a leader was found necessary for the proper regulation of the music and dancing. Then a responsive or dialogue element was introduced, the leader discoursing with his chorus in measured speech. Then the poet-leader became a real actor, who personated different characters by changing his mask. While he was out of sight, changing his mask, the chorus, under a new leader, took up the time with choral songs which commented on the action.

We know that by the time of Pisistratus these rustic festivals had become so popular that that enlightened tyrant brought them to the city and made them a public charge. Henceforth "goat-songs" were performed with great splendor at the city Dionysia in the spring. Æschylus introduced a second actor, Sophocles a third; and this small cast of actors was able, by change of mask during the performance, to represent all the characters needed for a somewhat elaborate action. Just how it came about that the main performance presently lost touch in a great degree—never entirely—with the riotous cult of the wine-god, we do not precisely know. It is an open field for speculation. At any rate that which had been a rustic orgy quickly evolved into a national dramatic festival in which all Hellas took an interest.

The enormous prestige of Greek tragedy, as the most im-

must have his enemy who is like himself; then we must have the contest, the tearing asunder, the messenger, the lamentation mixed with joy-cries, the discovery of the scattered members—and by a sort of doubling the discovery of the true God—and the epiphany of the dæmon in glory."

pressive artistic fact in the life of the most artistic people that ever lived, has so bewitched the modern imagination since the Renaissance that we easily overlook the essential ugliness of the raw material out of which Æschylus, Sophocles and Euripides built up their stately illusions. The *Stoff* of a Greek tragedy is nearly always a tale of revolting crime and horrible expiation. Nearly one-half of all the extant dramas relate to the loathsome history of two royal lines, that of Pelops and that of Labdacus. And what a chamber of horrors it is into which we are ushered! Tantalus, the son of Zeus, kills his son Pelops, boils the body and serves it up as a feast for the gods. Restored to life, Pelops wantonly kills the charioteer Myrtilus, who had helped him by fraud to win a kingdom, Atreus, son of Pelops, kills the children of his brother Thyestes and gives them to his father to eat. Agamemnon, son of Atreus, is killed by his faithless wife Clytemnestra, who in turn is murdered by her son Orestes. Such is the order of facts which occupied the imagination of Æschylus when he wrote his magnificent trilogy.

Again, King Laius of Thebes is warned by an orcale that he will die at the hands of his own son. To defeat the oracle he exposes the infant Œdipus to death; but the child is saved, grows up to manhood, slays his father unwittingly, marries his mother Jocasta, and has by her two daughters and two sons, the latter of whom kill each other in battle. The horrified mother hangs herself. Œdipus puts out his own eyes and wanders about in helpless misery.—This revolting story underlies the three greatest plays of Sophocles. It is true that in a few plays there is no element of loathsome horror. But they are inferior in poetic power as in dramatic interest. The greatest Greek plays are visualized tales of abominable crime and its consequences, or else of excruciating agony.

But after all, that which interested the Greek poet and

the Greek spectator was not so much the visible horror and the visible agony as the relation of crime and suffering to the moral government of the world. How can such things happen if there be gods who rule the world wisely and well? The central problem of the great Oresteian trilogy is simply this: If a son kill his mother because she has killed his father after dishonoring his bed, shall that son be justified of the higher powers or not? Æschylus answers in the affirmative. As is well known, the mind of Sophocles was ever turning on the ethical bearings of his theme. And what wonder if he accepted the idea of an over-ruling *moira* or fate, to which the gods themselves were subject—a mysterious destiny which must work itself out, even if sometimes, as in the case of Œdipus, the man himself was conscious of no wrong-doing.

The peculiar type of performance which the Greeks developed out of their Dionysia has not only furnished the modern world with its customary name for the serious drama, but has had an important share in fixing the mental associations of the word "tragedy." In their miscellaneous borrowing of things Greek the Romans never really borrowed Greek tragedy, but they did develop a literary interest in it. This interest appears in the tragedies of Seneca, for whom the essence of the matter seems to have been the excitation of nerve-thrilling horror. He borrows the staple Greek themes of fiendish crime and awful retribution, and his characters express themselves in pompous rant. It should be remembered that Seneca lived in an age when monstrous murders were very common in high circles, and that he held suicide to be the noblest mode of self-rescue from an intolerable situation.

It is now well understood that the real parent of the modern drama, which sprang up in the wake of the Renaissance, first in Spain, then in England, then in France, was the medieval popular drama which had existed in the

various forms of mystery, miracle-play, morality, chronicle play and shrovetide farce. But in the latter stages of the slow and gradual process whereby an artistic drama of literary importance evolved out of these crude medieval forms, the classical tradition came in as an influence making for compactness, dignity and concentration. It was weakest in Spain, strongest in France. Nowhere, however, was what we call the classical tradition a body of ideas deriving directly from the Greeks. The ideas came rather from the humanists, who harked back to Roman literature. It was not the peerless playwright Sophocles, but the ranting horror-monger Seneca who represented for the humanists the perfection of the tragic art as practised by the idolized ancients.

It was partly for this reason that the new tragedy became in the main a tragedy of blood and vengeance. Of course this was not the only reason. By virtue of his evolution man is a fighting and blood-letting animal. We may wish it were not so, but the fact remains. For mankind taken by and large nothing is so interesting as a spectacle of fierce passion leading up to bloodshed. In looking at such a spectacle, in vividly realizing its details, in thinking about it, they get that emotional excitement which is life, and which is, at the same time, the ultimate ground of the universal passion for mimic representations. No wonder, then, when the early English playwrights began to make plays for people who had paid their money to see a show; when the main purpose was no longer to better morals or to build men up in the religious life, but to provide emotional excitement, so that people would come again and bring their friends and swell the receipts—no wonder that the early playwrights saw the advantage of providing plenty of murder. This much they hardly needed to learn from abroad. But some of them were young scholars fresh from the university, who found in play-writ-

ing the shortest road to livelihood and fame. For such men it was natural to eke out their own supply of atrocities by drawing on the supply of antiquity, and especially to take hints from the great horror-monger Seneca.

In the hands of Shakespeare, as all the world knows, the tragedy of blood and vengeance speedily developed into an incomparable art-form which, like that of Sophocles, marks a new culminating-point in the history of dramatic achievement. And is it not a little singular, when one pauses to think of it, that all the wealth of thought and the imaginative splendor which we admire in the Shakespearian tragedy should have been largely called into being by the contemplation of murder and vengeance? That the noblest of all our literary forms should be thus deeply rooted in the subsoil of man's inhumanity to man?

CALVIN THOMAS.

COLUMBIA UNIVERSITY, NEW YORK.

THE PERSON OF JESUS CHRIST IN THE CHRISTIAN FAITH.

THE theory of the non-historicity of the central figure of the New Testament is to-day in the position of the stone spoken of in the scriptures as having been refused by the builders of the temple. Those who profess to be builders of the temple of modern Christianity will have nothing to do with it. One calls it " a negligible extravagance," another describes it as "grotesque," another avers that any one who professes to hold it "ought to have his bumps examined." It is verily disallowed of men. Whether it is "chosen of God and precious" does not, of course, necessarily follow; all that is claimed here is that the fact of its being rejected by the builders does not of itself prove that it is worthless. That can only be determined by the fact whether or not it fits into the vacant place in the wall where the stone is needed. In the legend to which reference has been made the rejected stone became the chief stone of the corner. It was the one stone needed to complete the building. It is the belief of the writer that the theory of the non-historicity of the central figure of the New Testament is the only theory which will explain the New Testament, the only theory which will introduce coherency and intelligibility to contemporary Christian theology, the only theory which will heal the divisions between liberal and orthodox and present a rational Christianity to the modern mind which will accept no other.

It is not claimed that the non-historicity of the central figure of the New Testament has been proved or can be proved. No one can prove a negative, and certainly no one could prove a negative such as this would be. It would amount to a claim that one had examined every nook and cranny of the Greek and Roman world in the first century and before, and found no Jesus. Such a thing is clearly preposterous, and no such thing is even hinted at here. What is claimed is that the central figure described and implied in the New Testament is not a person who could have lived within the range and limits of history, that the attempt to interpret the New Testament on the theory that its central figure was historical breaks down. The New Testament refuses to be explained on such a supposition. To explain the New Testament one must begin with some working theory or hypothesis. Such working hypothesis or theory is not proved to begin with, but taken for granted with a view to seeing whether it will account for certain facts. The strength of the theory lies in its power to account for the facts involved. If it does account for them completely, this is regarded as the strongest possible evidence of its truth and the theory is then considered proved. For example, the Ptolemaic theory of astronomy which assumed that the earth is the center of the solar system, and that the sun revolves round the earth, was for centuries regarded as proved because it seemed to account for the movements of the heavenly bodies. It was seen to be a complicated theory,

> "With centric and eccentric scribbled o'er,
> Cycle and epicycle, orb in orb,"

and there were not wanting those who doubted its truth. It held its place, however, till the sixteenth century when the monk Copernicus propounded another theory, its direct reversal, inasmuch as it assumed the centrality of the sun and the revolution of the earth round it. Since then the

Copernican theory has been everywhere regarded as proved, because it is seen to fit into the facts of the universe as a key fits into the wards of its lock.

When an increasing number of facts is left unaccounted for by a theory which has long been accepted, it is time to doubt the validity of that theory and seek another. This is the condition in which the Christian world at present finds itself in relation to the question of the origin of Christianity. Up to the present time the New Testament has been read on the supposition that its central figure was historical. There have been occasional protests throughout the ages, but these have been silenced by the authoritative voice of the dominant church. It will be granted that if this supposition be not well founded there will be no possibility of understanding the New Testament. This is not to say that it will be wholly misunderstood, that no good will be got out of its perusal or study, for the spiritual quality of the precepts and parables and incidents of the Gospels, the ethics of the Epistles, remains the same whatever theory of the origin of the literature be held. At the same time the New Testament will be thoroughly misunderstood if the presupposition that the central figure of it on which all study of it has been based hitherto was a historical person be not well founded. This is not a question of either ability or scholarship. No amount of ability or of scholarship will avail if a radically wrong point of view be taken at the start. This may be illustrated by a reference to the Old Testament. The higher criticism has taught us to read the Old Testament by showing the birth-succession of Israel's thought concerning God and man. We are enabled to see that that thought was a true development according to the law of normal evolution. As the books of the Old Testament are arranged in our Bible the natural order is reversed, and everything is topsy-turvy. It is as if in the arrangement of English literature we should place the

scientific books of the nineteenth century before the dramatic literature of the Elizabethan age, and attempt to read and understand the literature in that order. We might, of course, get some good from such a reading and appreciate many beautiful individual gems of poetry and prose, but we could not understand the literature as a whole. To understand the Old Testament we must follow the order in which the higher criticism places the books. The one central fact which the higher criticism has made clear is the priority of the prophets, and the late authorship of the so-called books of Moses. We now understand that the order in which the books stand shows the order in which they became holy scripture, the order in which reverence began to attach itself to the literature, not the order in which it arose. But to read it intelligently we must read it in the latter order, and not the first. The stories of "beginnings," of creation, of the flood, of the Patriarchs, of the migrations, of the exodus, the elaborate legislation of Leviticus and Numbers, Deuteronomy or second law, the histories of the kings of Judah and Israel—all are developments of the principles laid down by Amos, Hosea, Micah, Isaiah, and their successors. All this illustrates the importance of a right point of view, and the impossibility of understanding any piece of literature until that is gained.

Suppose now that the authors of the New Testament did not mean that their account of the central figure of the Gospels and Epistles should be taken as historical, or that, as a matter of fact, actual investigation shows that it is not historical, then no ability or scholarship will avail; the study of the New Testament will be very largely misdirected effort, and the results of such study will be confusing and misleading, and that in spite of the purity of motive and earnestness of purpose that have gone into the study.

There has been an uneasy feeling in the minds of many earnest students of the New Testament for some time that something was wrong. The results of such study are so contradictory and confusing. It is a commonplace to-day in all intelligent circles that the theology of the churches is in a very unsatisfactory state. No clear, well understood message comes from the pulpits of these churches. There is a perfect passion for vague statements, and what seems a deliberate attempt to ignore even the well established results of the higher criticism so far at least as these bear upon the New Testament. There is a willingness to admit these results in regard to the Old Testament, but it is no exaggeration to affirm that the leaders of the official churches are trying to go on as though nothing had happened. Texts are quoted from the Fourth Gospel as proving what Jesus said, when every one knows that the critics have given up that Gospel as being in any sense a history of Jesus. The same may be said, in truth, of the Synoptics and Epistles, though it is not so widely acknowledged. The length to which the policy of ignoring the results of well established scholarship is carried even by those who profess to be liberal is amazing. There seems to be a veritable conspiracy of silence entered into by the leaders of the official churches of Christendom in regard to New Testament criticism. The people, generally, feel the unreality which has smitten the churches, though of course they cannot tell the cause of it. The leaders of the churches, for example, wish it to be still understood that the "gospel" they preach is the story of a divine being who had his abode in heaven prior to his incarnation, that he came to earth to suffer and die for man, that his sufferings lasted only a few hours or a few years, and that after they were over he was received into heaven with the acclaim of angels and archangels and the approval of his father. They imply that this story is historically true, and they present it

as the most wonderful manifestation of love and sacrifice in all the world. They expect the people to prostrate themselves before this "story" and worship it. But the people feel the unreality of it, though they may say little about it. They easily see that thousands of men and women in every age have done far more than this, and that too with no expectation of reward, having had to die in the dark. Many reasons are given why the people are leaving the churches; may not the chief reason be here,—the failure of the message of the churches to produce in the minds of the people any sense of reality? The "gospel" as presented by the churches does not "ring true" as history. The cause of all this is really not far to seek. The intelligent study of the New Testament is only about one hundred years old. Albert Schweitzer's *Quest of the Historical Jesus* sums up the attempts that have been made during that time to write the life of the central figure of Gospels and Epistles. The book has been well described as "a cemetery of discarded hypotheses." The main result of the book is to show the utter failure of the attempt to write a Life of Jesus. This is a most remarkable result when we remember that the ablest and most consecrated minds of Christendom have been engaged upon the task. It surely suggests the query whether the point of view occupied by the writers is the correct one, and it makes reasonable the attempt to see whether another and radically different standpoint will not give better results.

We have gone far enough to know where the trouble lies. There is an inner contradiction in the way the Christian church has conceived of him whom it has called its Lord. It has worshiped him as God and it has tried to follow him as a man, and it has been justified in this by the New Testament itself. The writers of the New Testament worship Jesus as a God, and they portray him with human traits of character which are to be imitated by his fol-

lowers. Nowhere, perhaps, has this inner contradiction been more clearly set forth than in a book almost forgotten now, published thirty-five years ago, *The Resurrection of Jesus Christ* by Reginald W. Macan. The author shows that both members of the inner contradiction have remained beside and outside each other "false in its special onesidedness, and each justified in its onesidedness against the other. If Christ is God, he is not man; if man, not God." He finds a parallel to this contradiction in the antithesis of matter and mind which has dominated modern philosophy ever since Descartes; "the same process of one-sided assertion repeats itself here, with the same solution, which is no solution." The progress of metaphysics exhibited, just as the progress of theology had done, "the continual separation and driving out of one another of the two elements originally set in juxtaposition, now the exclusive assertion of the one, now the exclusive assertion of the other, and then their attempted reunion by means of a third, which in its turn must fall into the same elementary antithesis, or finally, their bare reassertion, one beside the other." The right standpoint for the solution of the inner contradiction in science and philosophy is the principle of unity, of metaphysical monism, because it abolishes the absolute dualism which implies a contradiction in the ultimate nature of things. The same contradiction is involved in the church doctrine of the divine and human in the person of the Jesus of the Gospels and Epistles, a contradiction "before which nothing awaits us but permanent intellectual confusion." The only legitimate metaphysics must be monistic; so the only legitimate theology must be monistic, and also the only legitimate Christology must be monistic; and the question of questions is how this monism is to be reached.

The way of the liberal theology has been to emphasize the human side of the central figure of the New Testament

to the exclusion of the divine side. It began its course by repudiating the supernatural Christ of the church in the interest of a Jesus who was purely human, and the whole effort of the liberal critics for the last half-century has been to find this human Jesus. The result is stated succinctly by Schweitzer in the last chapter of his book. "There is nothing more negative than the result of the critical study of the life of Jesus. The Jesus of Nazareth who came forward publicly as the Messiah, who preached the ethic of the kingdom of God, who founded the kingdom of heaven on earth and died to give his work its final consecration, never had any existence. He is a figure designed by rationalism, endowed with life by liberalism, and clothed by modern theology in a historical garb." This is not meant to deny that a Jesus of some sort existed at the beginning of our era; it denies that the Jesus of the liberal critics existed then; it affirms that the Jesus of the liberal critics is the product of the imagination of the liberal theologians themselves.

This failure of the liberal theology to reduce the central figure of the New Testament to the dimensions of a man ought at least to justify the attempt to interpret the New Testament on the theory that that central figure is a God. The situation is very curious. No attempt is made on the part of the strictly orthodox to show that their Christ was historical. It seems to be taken for granted that such a task is impossible of accomplishment. It is left to the liberals to prove the historicity of Jesus. And the reason of this is that the only Jesus who can be historical is a human Jesus. "The Absolute," said Lessing long ago, "never descends into history." "God never speaks," says Emerson. The meaning of these great sayings is plain. They do not deny the presence of God in history, or that God speaks through the lives of men; they mean that God does not, as God, descend into history and that

God does not speak in articulate words. Whenever any words are represented as having been uttered by God, it will be found that they have come through the lips and heart of some man. And this at once answers the objection that the non-historicity of the central figure of the New Testament implies his unreality, the implication being that what is not historical cannot be real. There is a type of mind that cannot see any reality in a story unless it be historically true. It is akin to the type of mind that asks what a poem proves! Both Lessing and Emerson could be cited to show that both believed in the reality of deity. Both believed that the universe is the manifestation of deity, and that in a higher sense God is continually speaking. The theory that affirms that the central figure of the New Testament is non-historical, no more denies its reality than the affirmation of the non-historicity of the central figure of the Old Testament denies the reality of that. The central figure of the Old Testament is the God of the Old Testament. There is no one who will contend that the God of the Old Testament was an historical character. He was not a being who appeared within the range and limits of history. There is all the difference in the world between any historical character of the Old Testament, such as Abraham or David or Isaiah, and the God in whom these men believed. The conception or idea of God varies at different periods of the history. One of the charms of the study of the Old Testament is in tracing the stages through which the idea passed as the experience of the people widened. The God of the patriarchs is not the God of the prophets, and the God of the prophets is not the God of the priests of later Judaism. In the early ages he was El-Shaddai, God Almighty; to Moses he was known as Yahveh; to the psalmists he was the father who pitieth his children; and to the prophets he was the God of righteousness, who demanded righteousness from his people. There are in-

deed stories of miracle in which we are told that the natural and historical order was broken, and God appeared to men in visible form. Without entering upon the vexed question of miracles, there is no one who would affirm that the reality of the God of the Old Testament depends upon these stories. He is *in* the whole history, though above it controlling it, and while he never descends into history, never appears in bodily form, is in no sense a historical character, yet he it is who gives reality to the whole course of development. How real was Yahveh to the prophets and psalmists! We do not make the mistake of identifying the God of the Old Testament with God as he is in himself. We say that Yahveh was God as the Hebrew was able to conceive him. The real God reveals himself to men through their own thoughts of him, through their experience; their idea of God is the reaction or reflection of their experience. This is a universal principle. The world in which man lives in any age or land is never the actual things as they are, but his thought of these, the reaction of his experience upon these, the *Ding an sich,* as these are reflected in and through his experience. Just as it is a mistake to say that we do not know the things in themselves because we know them through phenomena, for the phenomena reveal them rather than conceal them, so it is a mistake to say that we do not know God because we do not know Him as he is in himself. All our knowledge is relative; hence the idea of God varies in different lands and ages. The Old Testament gives us, as I have said, the true birth succession of Israel's thought about God. Each stage of the development gives us a different aspect of God. We never say that there is no revelation of God in the Old Testament, because God did not incarnate himself in the course of its history. That is to say, the non-historicity of the God of the Old Testament does not militate against his reality. We never say that because he was not historical he was

mythical in the sense of unreal. If we mean that Yahveh was the name of some tribal deity, we are doubtless right enough, but that is an incorrect use of the word myth. Whatever name men give to God must be derived from somewhere; it cannot come from the sky. Barton in his *Semitic Studies* gives reasons for the belief that Yahveh was originally the name of a mother goddess, going back to the time when the family descended through the mother, and when, as a consequence, the deities were feminine. All this, however, does not justify us in calling Yahveh mythical, far less does it justify us in making him unreal. It is a most superficial notion that what is not historically true is not true at all. Cannot God reveal himself through the thoughts of men? Which is the more real, matter or spirit? Which would be the more enduring, a writing by the finger of God on the sands of Palestine, or an inbreathing into the living minds and hearts of men? Which is the more likely method of revelation, and which would bespeak the greater reality? There is, I am sure, only one answer to such questions.

Now the central figure of the New Testament is the logical successor of the central figure of the Old Testament. It is that universalized and Hellenized. The central figure of the New Testament is the God of the New Testament. Just as there is all the difference in the world between any historical character of the Old Testament and Yahveh, so there is all the difference in the world between the Jesus Christ of the New Testament and any historical character mentioned there, such as Paul, or John, or James, or Peter. The one outstanding feature of the New Testament is the worship of its central figure. Just as Yahveh in the Old Testament is an aspect or appearance of the one eternal God—the eternal God as understood by the Hebrew, seen through the experience of the Jewish people, the reflection from their experience of life—so it is with

the Jesus Christ of the New. Whenever one affirms the non-historicity of the central figure of the New Testament he is at once charged with affirming that he was a mere myth imagined by the early Christians. But nothing could be more unjust than this. The alternative is not history or myth, else all who affirm the non-historicity of Yahveh affirm with the same breath his mythical character. An immense deal of prejudice has been created or excited against the non-historicity theory by the publication of Professor Drews's *Die Christusmythe*. Probably because of that book, the man in the street, if not the man in the drawing-room as well, will persist in calling it the "mythical" theory. But all the same the term is essentially inapplicable. The alternative is better put, history or symbol. To say that the story of Jesus is non-historical is not to say that it is mythical; it is to say that it is symbolical. The myth is always unconscious and unreflective on the part of those who tell it; whereas the symbolism of the New Testament is perfectly conscious and deliberate. The late Prof. G. P. Fisher of Yale states the difference between myth and fable or parable with his usual exactness. "There is no consciousness on the part of those from whom the myth emanates that the product of their fancy and feeling is fictitious. Both fable and parable are the result of conscious invention. In both the symbolical character of the narrative is distinctly recognized. From the myth, on the contrary, the element of deliberation is utterly absent; there is no questioning of its reality, no criticism or inquiry on the point, but the most simple unreflective faith." Now a careful examination of the Gospels shows that the symbolism employed is of set purpose, indeed the deliberation is intensely conscious, hence it is far removed from myth and comes under fable or parable or allegory. Nothing, therefore, could so misrepresent the non-historicity theory of the New Testament as the phrase "the Christ Myth,"

and that, unfortunately, is the phrase by which it is most widely known. The real truth is that it affirms the essential divinity or deity of the central figure of the New Testament as against the critics of the liberal school who have expended ability and learning for over half a century in seeking to disprove this divinity which has been the doctrine of the church from the beginning, and to make out that both the church in all the ages and the writers of the New Testament were alike mistaken, that this divinity which has been attributed to him was merely the idealization or apotheosis of the early Christians, blundering attempts to account for the impression which Jesus, a great and good Master who was a man like themselves, had made upon them. The liberal theory is that Jesus was a man to begin with, which of course he must have been if he was historical—a wonderful man, but still a man. Some of them exhaust language in setting forth his greatness, but he was strictly within the limits and range of history. Every feature which has made him the divine Saviour of the church has been taken from him and he has been presented as "a man among men." These features grew, it is affirmed, like an accretion about him, and it has been the function of liberal critics to peel this accretion off and so to get at the realistic human figure.

The effort of the liberal critics finds its culmination and completion in Professor Schmiedel's nine pillars—nine passages in the Synoptic Gospels used to prove the modern critical theory of a purely human Jesus. These nine passages Professor Schmiedel characterizes as "the foundation-pillars for a truly scientific life of Jesus." "Were such passages wholly wanting," he continues, "it would be hard to make head against the contention that the Gospels showed us everywhere only the picture of a saint painted on a background of gold; and we could, therefore, by no means ever know how Jesus had in reality appeared—nay,

perhaps, whether indeed he had lived at all." Here the whole animus or motive of the liberal critics comes out—the underlying idea of their whole contention—if Jesus was historical he was a man; no one of them would point to the supernatural features of the life as proof that the life was historical. In other words, if Jesus was historical he was a man in the same sense as Socrates was a man, and therefore the human traits are the proof of his historicity. They never weary of pointing out the absurdity of denying the historicity of Jesus on the ground that it would be absurd to deny the historicity of Socrates or Alexander or Napoleon. Professor Schmiedel admits that in a large part of the synoptic Gospels "Jesus appears as a divine being, whether in virtue of what he says or in virtue of what he does." But the point is that in these nine passages he does not appear as a being to be worshiped, but as a "man among men." There is no space here and now for the examination of these nine passages. It must suffice to say that it can be shown that not one of them bears out his contention. And the eminent professor makes two large assumptions when he premises that no worshiper of Jesus could have attributed to him human traits as these passages do (because the worshipers of the gods of paganism often attribute to their deities human traits) and that they are primitive and not late. These assumptions vitiate his conclusion. No one denies that Jesus is spoken of as a man in the Gospels; the crucial question is: which way of speaking of him is the primitive one? According to the theory of Professor Schmiedel, and of the liberal critics generally, Jesus was a man—more of a man, indeed, than ordinary men, but still a man—and the divine attributes with which he is clothed in the Gospels are later accretions, so that as he appears in the New Testament he is a divinized man.

Now if that had been the process of the development the New Testament would have shown it. By all the

canons of probability traces of this process would have appeared. In the early parts of the New Testament there would have been many proofs of the purely human character of Jesus; and then as time went on the divine traits would have been added. But the opposite is the actual process. First we have the divine being. As Pallas Athene is fabled to have come full fledged from the head of Zeus, so Jesus came from the first writers of the New Testament a full fledged divinity. The evidence of this is on the face of the New Testament. The process of development, therefore, was not that of a divinized man, but that of a humanized God. He was conceived of by the very first Christians as an aspect or person of the One God. Using the word "person" in its classical sense of a mask worn by the actor on the stage, he was a person of the one deity; the great Pauline verse in 2 Corinthians iv. 6 "For God who commanded the light to shine out of darkness, hath shined in our hearts, to give the light of the knowledge of the glory of God in the face (or aspect, or person) of Jesus Christ," is an instance of the way in which he was conceived in the earliest times. Who shall say that the "shining" was less real because it was "in our hearts," and not in outward form, in history? If so, the whole revelation of God in the Old Testament is nullified because that was all subjective, that is, in the minds and hearts of men, and not in outward form. The fact that the names "Jesus" and "Christ" were names of deities prior to the beginning of our era, no more militates against the reality of the revelation in the face of Jesus Christ, than the fact that Moses got the name "Yahveh" from a Kenite tribe dims the glory of the revelation through prophet or psalmist.

All rational study of the New Testament must, then, begin with the divinity of its central figure. The *fons et origo* of the Christian movement was not a human being,

but an aspect, or character, or person, of the one eternal God. Jesus is worshiped in the New Testament as God, and it is a most significant fact that the Christian church has followed the example of apostolic Christianity in this respect in all the ages of its history with very rare exceptions. What likelihood is there that the theory which has been held by the church without any critical inquiry, that the divine Jesus Christ of the New Testament was an historical person or individual, will continue to hold the credence of men? The church has been right in its contention that Jesus Christ, as the New Testament presents him, is a divine being; but it cannot rebut the arguments by which liberal Christianity has shown that the passages which have proved this divinity do not recite historical facts. The work which has been done by liberal Christianity, in showing the non-historicity of those parts of the New Testament which have been the proof-texts of the orthodox church, is a work which has been done for all time, and can never be undone. We may be sure that no so-called "facts" furnished by the Society of Psychical Research, to which some in their desperation are appealing, will in the end succeed in restoring those parts of the New Testament to the credence of men. What an uncertain, precarious foundation on which to rest a great religion like Christianity this would be were it possible! Not in this direction is help to be found, but in a frank acknowledgment of the facts of the situation, which are that the worship of Jesus is of the very essence of the religion of the New Testament, and that the human traits with which the writers clothe him are symbolic and not historic in their character.

The first thing that needs to be grasped is just what it was which formed the burden of apostolic preaching. What was the message proclaimed by Peter and Paul, by Matthew, Mark, Luke and John, in its essence? The writings

of Paul are proof positive that it was not the fact that a great teacher had been born in Palestine; for these writings are not a recital of his teachings. There are no teachings of Jesus in the Epistles of Paul, no sermon on the mount, no parables, no Lord's prayer, no *Logia*. The essence of the apostolic preaching was the worship of the one God under the aspect or character or person of Jesus. It is quite manifest that Jesus was not the only name which was used to carry this great doctrine. There was the name "Christ" which with "Jesus" was the name of a divine or semi-divine being before the Christian era. These two were brought together as the name of one being by the movement which afterwards became historical Christianity; but neither the one nor the other denoted at first a historical person. The idea that "One was to come" was familiar in all the circles of the Jews scattered up and down the Greco-Roman world; and all that was needed for this transition to take place was that a story should arise that "the One had come." It is the luminous suggestion of Mr. Thomas Taylor in his *Origins of Christianity* that the occasion of this transition was the destruction of Jerusalem in the year 70. Before that catastrophic event there were no Christians in the sense of believers in a historical Jesus; there were only Messianists, or Believers in "One to come." It is these Messianists who are meant by Tacitus in the famous passage in which he records that Nero put on the "Christians" the blame of setting fire to Rome. The great historian mistakes the Messianists of Nero's time for the Christians of his own day,—a very natural mistake for a high-born Roman to make. In the apocalyptic passages in the Gospels which predict the end of the world, or age, and which are curiously mixed up with the destruction of Jerusalem, we are to see the evidence of the existence of this earlier Messianic movement.

But the names "Jesus" and "Christ" were not the only

names that stood for the worship of the One God which we must never forget was the original content of the new religion. In the different names which were in vogue we may see an evidence of the fact that the movement in behalf of monotheism, the worship of the One God, was very wide spread. It is difficult to see on the supposition that the originating source was a historical individual, how there could have been these different names. There were "Son of Man," "Second Adam," "The Man from Heaven," "The Nazarene," "Great High Priest," "The Lamb," "Alpha and Omega," "Baradam," "Barnasa," etc., and these names, I repeat, are the evidence that there was a great cult or association with branches scattered all over the Mediterranean world which differed indeed in the method of presenting the great doctrine of the One God, but which were united in the doctrine itself. These differences in the names or aspects in which the doctrine was presented, let it be remembered, appear in the earliest parts of the New Testament, and are thus primitive, not a late growth; and therefore, could not have been applied first to one historical person. These names must have been symbols representing the new doctrine. It has long been seen that various ideas or phases of the Christ or Jesus are in the New Testament, and it has taxed the ingenuity of commentators to bring these into some kind of agreement. It has never been done, because there was no agreement to start with. The individual idiosyncrasies of the New Testament writers do not account for these variations, and there is no proof of one all-dominating personality. How could the representations of Paul, of John, of the apocalyptist, of Mark, be referred to one overruling person? So difficult have the critical commentators found this to be that some of them have given up the representation of John and of the apocalyptist altogether as telling us anything about Jesus. The whole thing becomes clear enough when it is under-

stood that they do not mean and were never intended to describe one person, but are the various aspects in which the doctrine of One God was conceived by different parties. There is only one thing in which all the various parts of the New Testament are united, and that is in asserting the divinity or deity of the aspect, or character, or person of the One God under whatever name. We can easily see why this must be so; because the essence of the doctrine proclaimed by the cult or community wherever found was "Fear God and give Him glory" (Rev. xiv. 7). This was the eternal Gospel for the inhabitants of the earth, and for every nation and tribe and language and people proclaimed by the angel in mid-heaven. Or to take it out of the language of the apocalyptist, the golden thread which runs through the whole New Testament is this doctrine of the One God, and in every case the names "Jesus," "Christ," "Saviour," etc., stand for this doctrine of One God.

In the fact that the cult or community which afterwards became the Christian church was originally a secret society, we have the reason why the symbolism of these names was used. The proof of this fact lies on the surface of the New Testament. I will cite only a few passages which might be indefinitely multiplied. Jesus is represented as teaching his disciples in a different way from that which he used with others. "Unto you it is given to know the mysteries of the kingdom of heaven, but unto them that are without it is not given." This is the reason why the teaching was in parables. It is usually assumed that the parable was used to make matters plain. That this was not the case is proved by the fact that the parable had to be explained to the disciples, and that its purpose for those who were without was that they should not understand it. "Therefore speak I unto them in parables; because they seeing see not; and hearing they hear not,

neither do they understand." "Fear not, little flock," Jesus is made to say again, "for it is your Father's good pleasure to give you the kingdom." "Many are called, but few chosen." "Cast not your pearls before swine, neither give that which is holy unto the dogs." "How is it that thou wilt show thyself unto us and not unto the world?" the disciples are made to ask the Master. For making the cult a secret society there were two reasons. Unwonted knowledge among the ancients was a very dangerous possession, and religious ideas other than those in vogue among the masses sought protection in obscurity. Wherever the human mind was active and spiritual there had arisen systems of exoteric and esoteric instruction, that is, of truth acknowledged and of truth concealed. And besides this general reason there were the special circumstances of the cult itself. Organized for the purpose of overthrowing the prevailing idolatry of the nations, and substituting the worship of the One God instead, it was exposed to the enmity and persecution of the nations. It was compelled thus to use symbols which were unintelligible to those outside but which were known to initiates, to the "little ones" or "little flock," to the "chosen." But while the primitive teaching of the cult or community was thus secret and esoteric, and that of necessity, the intention was to make it public as soon as that was possible. "Whatever ye have spoken in darkness shall be heard in the light; and that which ye have spoken in the ear in closets shall be proclaimed upon the housetops." There are evidences of controversy among the early members of the communities whether this open policy was wise. Some of the more cautious thought it was premature; others who were braver, perhaps, or more zealous, argued that the lamp was not intended to be put under a bushel or a bed, but on a stand that it might give light to all who were in the house. Paul was one of those who advocated the open method.

The mystery hid from ages and generations was now to be made manifest. The Gospel narratives are to be read as symbolic stories which "half revealed and half concealed" the hidden truth. One of the most patent of all symbolisms is the casting out of demons or evil spirits. What a trouble it has been to commentators to reconcile the perfection of Jesus with such a crude superstition as demoniacal possession! How clear it all becomes when one understands that by the demons or evil spirits were symbolized the gods of heathenism, and by the casting out of them, the deliverance brought by the doctrine of One God under the aspect or person of Jesus. That this is the meaning of demoniacal possession and its cure ought to be manifest from the fact that all such stories of healing or cure took place in Galilee, and none of them in Judea. It is unbelievable that the northern province was full of these demoniacs, and that the southern one was free from them. It becomes clear when we remember that Galilee was regarded as the peculiar home of idolatry, accounted for by the way in which that province was settled by heathens in early times. Hence the casting out of the demons was said to have taken place there.

The method of teaching by symbol was a continuation or result of the idealizing tendency in the Hellenistic synagogues of Diaspora which interpreted the Old Testament allegorically. It was the conviction of these early Christians, who, however, were not yet called Christians, that Judaism had not brought the true knowledge of God. We call these men Gnostics, men who knew, men who had attained to a higher knowledge of God, who had, under the influence of Greek philosophy, spiritualized Judaism and were aiming at the reconstruction of a universal religion which would appeal to all minds. One of the most signal triumphs of scholarship within recent years is the proof that this Gnosticism antedated Christianity, that the latter

was the outgrowth of the former, instead of *vice versa* as has long been supposed. With these Gnostics Jesus became the symbol of a new divine knowledge of the One God, which they confidently believed would heal all the spiritual maladies of humanity. The New Testament will never be understood until it is clearly seen that the so-called historical Jesus with all the deeds attributed to him, with all the events that are said to have befallen him, his miracles, his death, his resurrection, his ascension, were symbols of the ideas of these Gnostics. The form of faith held by these men was on a higher level than that which very soon became the faith of the church, for very soon the unenlightened multitude made its voice heard as against these men who knew. One should not find fault with the course of history. It was, no doubt, natural that the world should not remain at the high level occupied by these Gnostics. Especially in view of the new race which was soon to overrun the fair fields of the old world, and form the population of the new, it was no doubt necessary that there should be a fall in spirituality. But this should not blind us to the fact that there *was* a fall, and that the historical interpretation of the Gospel stories which the church has given them, is on a distinctly lower level than the teaching of these Gnostics who were the first Christians. When we read that Jesus gave sight to the blind, that he cured the man with a withered hand, that he cast out devils, that he raised the dead Lazarus to life, we are to understand that the new divine knowledge attained by these men, who were, perhaps, the most spiritual men who ever lived, would give spiritual light and life to the crippled and dying pagan world. Instead of our Gospels being the product of fishermen, unlearned and ignorant, they were the work of deep thinkers who were perfectly conscious of the inner meaning of the parables and symbols they invented; they probably would have been astonished could they have foreseen

that their efforts to make known the truth would have been so greatly misinterpreted.

The gross literal interpretation of the Gospel stories, and of the Gospel story as a whole, did not come all at once; we can see it growing before our very eyes as spirituality declined. Ignatius lived in the first quarter of the second century, and in his Epistles we find him very much opposed to the spiritual interpretation of the Gospel, but he argues for the historical interpretation as one would who is putting forth something new, not as a conservative would speak who was confident that he represented the ancient view. The so-called Apostles' Creed, which defines Christianity as a series of historical facts, cannot be traced further back than the middle of the second century, even in its crudest form. Tertullian of North Africa and his older contemporary, Irenæus of southern Gaul, about the end of the second century, try to make out that the spiritual interpretation of the Gospel is a heresy of recent growth, but they do not succeed, though they did succeed in impressing their view—the historical interpretation—upon the mind of the church. The truth had to wait for recognition to a later day. The triumph of the Catholic church was synchronous with the triumph of the canon, and that again was synchronous with the triumph of literalism. Ever since that early day the interpretation of the New Testament according to the historical method has lain like an incubus upon the minds of men. Under its pressure the higher criticism of the New Testament, in its efforts to find something in the Gospel story which is historical, has denied the divinity or deity of its central figure, thus eviscerating the New Testament of all that makes it a Gospel message for humanity.

The restoration of the spiritual view of the New Testament, which, when completed, will restore divinity or deity to its central figure in the only way in which it can be

restored, has already begun. The critics have begun to recognize and acknowledge the symbolic character of the Fourth Gospel. As usual this is a compromise, that is to say, they wish to make out that the Evangelist does tell us of historical facts, but at the same time uses these historical facts as symbols of spiritual truth. Whether there were historical facts or not is immaterial. What is important is that they were used as symbols; therefore the spiritual truth is the supremely important thing. It has long been noticed that there are no parables in the Fourth Gospel, and that the miracles it contains are parables. Now it would be as foolish to affirm the historicity of the parable of the good Samaritan or of the prodigal son of Luke's Gospel as to affirm the historicity of the raising of Lazarus from the dead, or the restoration of sight to the man born blind, or the turning of the water into wine at the marriage at Cana of Galilee, or the feeding the five thousand with two fishes and five loaves, or any other miracle recorded in the Fourth Gospel. No one is shocked when it is affirmed that there never was a historical good Samaritan, that the character in Luke is a symbolic figure, just as the characters of the parable of the prodigal son are all symbolical and not historical. It is easy to see whence the author of the Fourth Gospel derived his miracle-parables. Take the raising of Lazarus from the dead. It immediately calls up the parable of Dives and Lazarus in the sixteenth chapter of Luke's Gospel. No one would be so foolhardy as to affirm the historicity of this parable. "The significant name" as Alford points out, Lazarus (Eleazarus = *Deus-Auxilium*) should have prevented the expositors from imagining this to be true history. The symbolism of it is very clear. Dives stands for the Jew who is rich in the law, the prophets, the promises and oracles of God. And Lazarus is the pagan who is dependent upon the crumbs that fall from the rich man's table. The rich man, as

Alford remarks, "is not accused of any flagrant crimes." The motive of the parable is not moral, but religious. The offence of the rich man, the Jew, was that he had not accepted the cult of Jesus, a fact which all history bears out. Luke gives a hint of one rising from the dead as a means of convincing the Jews that the new religion was a message from God, and affirms that they who had Moses and the prophets would not be convinced even by this. From this hint the Fourth Evangelist constructs his whole story, which is symbolic from beginning to end. It is quite manifest that he never intended to write history. The same remark may be made concerning all the other miracle-parables in the Fourth Gospel; and what is more important, the same is true of the central figure of the Gospel as a whole. That is to say, not only are the miracle-parables symbols of spiritual truth, but Jesus Christ, the hero of the Gospel, is a symbol of the doctrine of the one God, which was to bring life and salvation to the idolatrous pagan world. And that is to say further, Jesus Christ is an aspect or person of the one eternal God. To say that the Fourth Gospel is not historical is not to say that it is not true, for it is a very shallow conception that affirms truth only of what is historical. What John affirms of the Jesus Christ of his Gospel, that he is the life and light of men, that he is the bread of life, the door of salvation, the resurrection, and the life, the I am, is true of the one eternal God. In one word, the aspect or character or person of God which constituted Jesus the Christ, was the aspect or character or person of Saviour.

What is true of the Fourth Gospel is true also of the synoptics. "It must be recognized," says Pfleiderer, "that in respect of the recasting of the history under theological influences, the whole of our Gospels stand in principle on the same footing. The distinction between Mark, the other two synoptics, and John is only relative—a distinction of

degree corresponding to the different stages of theological reflection and the development of the ecclesiastical consciousness." Albert Schweitzer, who quotes this from Pfleiderer, exclaims (*Quest of the Historical Jesus,* page 312): "If only Bruno Bauer could have lived to see this triumph of his opinions!" Mark, the Second Gospel, has been accounted by the liberal critics the most realistic; but they have overlooked the dogmatic element which dominates Mark throughout. He is concerned with the doctrine that Jesus is the Christ, and while he gives his doctrine a historical form, there is no evidence either that he wrote history or that he intended to write it. The Second Evangelist is great on the power of Jesus over unclean spirits or demons, and these, we have seen, denote the gods of heathenism, and the power of Jesus, the power of the One God to cast them out. He speaks of Jesus having compassion upon the multitude, but it is not the compassion of one human being for other human beings which is meant, but the compassion of a deity for men. Mark conceives of Jesus as an Old Testament prophet conceived of Yahveh, that is, as a divine being. Much has been made of the attitude of Jesus towards little children as proving his human feeling; but a little examination shows that the little children mentioned were believers, which children in the ordinary sense could not be. They were the "babes" to whom God reveals the secrets which he conceals from the wise and prudent. These little children are nothing else but converts, proselytes or Gentiles, and the question which is discussed in the passages Matt. xviii. 2; Mark ix. 36, 37; Luke ix. 46, 48 is the one which was such a thorny one for the early church about the admission of these converts into the kingdom of heaven. When it is said that Jesus loved the rich young ruler, no human love is meant, because the rich young ruler is a symbol of faithful Israel, and not a young man at all. Throughout the synoptics

generally, and Mark in particular, Jesus is a wonder-working and oracle-speaking God, and not a human being. Whatever human traits are mentioned are symbolic, not historic.

Perhaps at no place does the non-historical character of the Gospel story come out more clearly than in the account of the arrest, the trial, the condemnation, and the crucifixion of Jesus. It is impossible to read the story of these so-called happenings as literal history. The evidence is on the surface so that he who runs may read. So plain is it that it is only a kind of hypnotism exercised by the glamour of history upon the mind of the average man dominated by the church that prevents him from seeing it. The whole story reads naturally as the successive scenes of a mystery play. In the first place the part played by Judas is quite an unnecessary one. It is implied that Jesus was not known and had to be pointed out; whereas the fact is according to the story itself Jesus had made a public entry into Jerusalem when the people had welcomed him by shouting "Hosanna" and by spreading branches of trees in his way. It is recorded that a little while before he had driven out the money changers from the temple, which surely would have made him sufficiently known to the police of the city and the authorities of the temple. And then the whole transaction is represented as taking place between Thursday night and Friday afternoon, which was an impossibility according to both Jewish and Roman law. A learned lawyer of Edinburgh, Mr. A. Taylor Innes, wrote a book a few years ago upon the *Trial of Jesus* in which he showed conclusively that the trial and condemnation were illegal from the point of view of both Jewish and Roman jurisprudence. The eminent author did not see—perhaps it was too early for him to see—that the reason why they are illegal is that they are unhistorical. The inference he draws is one of condem-

nation of the Jewish and Roman authorities which we are now able to see is wholly unwarranted. It was the only inference that could be drawn on the supposition that the matter is history. The facts as shown by competent students of Jewish literature are that at the time when the trial and execution are supposed to have taken place, none of the Jewish priests were judicial officers, or members of the Sanhedrin; the Sanhedrin itself had no criminal jurisdiction and did not sit in the only judgment hall where a death sentence could be pronounced; the provincial governors alone could condemn a man to death; the Roman procurator was not authorized to execute any judgment of a non-official court; a capital trial according to Jewish law-court procedure could not be consummated in one day, could not be held in the night, could not take place on Friday or on the eve of a festival day; the death punishment was inflicted for no blasphemy except that of pronouncing the tabu name of Yahveh, for which stoning was the penalty; crucifixion was not a Jewish mode of executing condemned criminals; and means were taken to make the execution of the victim as painless as possible by administering an anodyne to him. The inference drawn from these facts by infidel writers has been that the whole Gospel tale of the trial and execution of Jesus was a clumsy fiction elaborated by writers who were completely ignorant of the national constitution, social organization and prevailing customs of the Jewish people at the time when the alleged events were supposed to have taken place. Such an inference is unavoidable if we start with the supposition that the writers were writing history or were intending to write history. But this would prove not only that the writers were dishonest, but that they were foolish as well, for it is as plain as day that their story is not historical. But suppose that they never intended to write history, that the story is an allegory, a dramatized narrative with a

profound spiritual meaning, and that the interest of the writers like the interest of all mystics, was in spiritual truth alone and not in history at all, then at once a new face is put upon the matter. Then we see that we are at fault in not having spiritual imagination enough to take the writers' point of view. Why should they not take advantage of the common story of the miracle plays which we know were a familiar feature in the religious life of the time? Then we are not compelled to condemn the Jewish and Roman authorities unduly or at least unjustly, and we are enabled to credit the writers with a profoundly religious purpose. This theory lifts the veil that has so long covered the Gospels and discloses their true and beautiful meaning, the deeper sense intended by the writers themselves. It shows that the original sense is far grander, higher and more spiritual than has been supposed. It substitutes a satisfying and inspiring spiritual sense for a bewildering material one.

K. C. Anderson.

Dundee, Scotland.

THE RELIGION OF TRAGEDY AND THE CHRIST-IDEAL.

TRAGEDY (which literally translated means "goat-song") has developed from a sacrificial performance in which a male-goat was offered to Dionysus. Arriving from abroad the god used to enter with his followers in festive processions. He was accompanied by Silenus, the lover of the cup, by fauns and bacchantes raving like maniacs in exuberance of life. The ass appeared in the procession, carrying a shrine or Silenus or the god himself. Wherever the procession went, there was great rejoicing, for Dionysus spread life, joy, liberty, rapture and drunkenness.

In the Dionysian festival the adventures of the god are imitated. Having undergone suffering and death he has been born again and now he comes as a liberator and saviour. He offers himself as the exhilarating drink and is the martyr of his divinity. He, the offspring of the vine, passes through his first life as the grape. He is cruelly tortured and mangled in the wine-press; his blood is shed, and he passes through a process of fermentation to rise from the tomb again as the intoxicating drink of the vine.

The myth tells us that he was the son of Zeus and Semele, but that before his birth Hera, the wife of Zeus, induced Semele to demand that her lover should show himself to her in all his divinity. Since, however, as also

in the case of the Jewish Yahveh, no one could see God and live (Ex. xxxiii. 20) Semele died at the sight of this theophany and Zeus transferred the unborn babe to his thigh where it grew to full babyhood and was then born a second time; hence the child was called *Dithyrambos,* i. e., "he of two doors," the twice born, and the irregular meter of poetry celebrating his birth is called after him the dithyrambic measure.

Intoxication is here not regarded as a loss of self-control, but as divine obsession. The god himself is assumed to speak out of the mouth of the one who is drunk, who is inspired. Liberated from the bondage of flesh, of sorrow, and of all evil, he enters into a state of ecstacy and enjoys the bliss of divinity, of liberty, of pure spirituality.

Connected with the worship of Dionysus were the so-called mysteries, dramatic performances representing the destiny of the god, his passion, his death, his resurrection, ending in his triumphal entry into the homes and hearts of the people.

Orphic and other mysteries are parallel formations, and it appears that all of them were imported from the East, although we may be sure that mysteries, or, generally speaking, half dramatic performances and dances of a symbolic nature, were common to all people all over the earth at a certain period of their development. They existed not only in ancient Egypt, Babylonia, Phenicia and Greece, but also in Tibet, in Africa and even among the North American Indians. Under the symbolism of certain acts the initiated persons were taught in the mysteries certain religious doctrines such as the eternal reappearance of life and the immortality of the soul.

The priesthood of the old established gods of Greece may originally have been hostile or perhaps indifferent to the new movement of Dionysian mysteries, but the new

ideas were too powerful and became too popular to be ignored. It appears that the Eumolpids, the ancient priestly family of Athens, deemed it wise to incorporate the new methods in their own system of the Demeter cult, the worship of the earth-mother, and celebrated in annual repetition the Eleusinian mysteries in which the descent of Persephone to Hades was symbolized in a dramatic performance. The daughter of the earth-goddess, the maiden representing vegetation, dies annually in the fall and comes to life again in spring. The acts of the drama deal with the rape of Persephone, the search for her by the disconsolate mother and her friends, the instalment of Persephone as queen in the realm of the dead and her annual return in spring with the bloom of flowers as well as the fruit of the fields. The course of nature symbolizes man's destiny. To set forth the continuity of life a torch was handed from hand to hand, and the ear of wheat, the seed of future life, was worn by the initiates as an emblem of immortality.

We need not doubt that the performance of the fate of Osiris in the Egyptian ritual was kin in spirit, expressing the same idea. Osiris lived on earth as a benefactor of mankind, a lawgiver, as the inventor of agriculture, of writing, of science, of laws and the social order as well as of civilization in general. Egyptian religion knows of his death and his descent into the underworld where he becomes the judge of the dead endowed with the power to give to those who have obeyed his commandments a life of bliss in the fields of Aalu, the Greek Elysium.

Orpheus, the Thracian singer, was another figure in the mystery religions. We know that he lost his beloved wife Eurydice and followed her into the nether world where with his sweet song he touched the heart of the stern Hades. Hermes, the leader of souls, accompanied the faithful lovers back to life, but Orpheus could not re-

strain himself and, contrary to the dictates of the law in the land of death, he turned to behold his bride, and she disappeared. The details of the mystery performance are lost to us; we only know that Orpheus sings to the lyre, that the whole creation, especially wild animals, come to listen to his enchanting strains and that he is killed and torn to pieces by his own worshipers, by the mænads who rove with him through the mountains.

All these mysteries, these dramatic presentations of the destinies of suffering gods who offer up their lives for the good of mankind, are tragedies, and comparative religion on the basis of anthropological research among savage races has discovered that they are a modified form of prior human sacrifices. It was the god's death that was enacted, and it was the god himself, his incarnation, his representative on earth, the high-priest of the tribe or the king himself, who was originally offered as the victim, as the *hostia,* and eaten. We live by eating the god of life, by nourishing ourselves with bread, the fruit of the fields, and by drinking the blood of the grape, and in the days of savagery it was deemed necessary to perform the act in all its cruel barbarity for the sake of perpetuating this divine munificence.

In the progress of civilization human sacrifices were abolished, and the sacred animal of the god was accepted as a fit substitute in the story of Abraham who offers a ram in the place of his son, Isaac. The symbol replaced the actual deed just as the hungry souls, originally fed with real food, had to be satisfied with the viands painted on the walls of their tombs (as instanced in the chambers of the dead of ancient Egypt); and while originally a master's slaves were killed to serve him in the other world, in a more cultured age a number of figurines (the ushabtiu of the Egyptians) were placed in his grave to serve the same purpose.

Is there any need of asking the question, why this idea of the suffering god, his death and resurrection, is so common all over the world and among so many nations? It is obvious that this doctrine symbolizes a great truth. It is undeniable that the maintenance of life and its renewal become possible only by constant sacrifice, and the heroes of mankind are martyrs whose struggles and whose passion are the condition of a victory over evil, of the attainment of prosperity, of life and of liberty. Such has been the religion of mankind, such is the fundamental idea in the Christian faith, and such will remain the religious ideal of the future.

The kinship between the old mystery religions and Christianity was recognized by the early Christians who pictured Christ as Orpheus in the Catacombs at Rome.

We need no longer wonder that Christianity spread over the world like a wildfire on the prairie after a drought. The nations were prepared for it. Indeed they had been believing in religions which had been born of the same spirit and were based upon the conception of life as a tragedy. The grotesque mythologies of the old gods were no longer acceptable to the more civilized age, while the story of the tragedy of Golgotha was more human, and therefore more humane, although the underlying truth was not different.

The formation of the Christian doctrines is by no means an accident. The life of Jesus (if he was, as we need not doubt, a real personality) was read in the spirit of these traditions, and the old pagan beliefs were superadded upon the story of the carpenter's son of Capernaum. Hence it is easy to point out the traces of myth and legend in the Gospels and there is no doubt that the saviour ideal existed before Jesus. It existed long before the origin of Christianity, not among the Jews alone, but among all the races of mankind; and this saviour ideal assumed a new form

after the breakdown of paganism in the new religion of Christianity.

In Christianity the belief in a saviour was reestablished in a new and purified faith. The saviours of the pagans were heroes, sons of Zeus or other gods, they were gods walking on earth, they were fighters with a club or sickle sword, but Jesus is a spiritual hero, the teacher, the healer, the benefactor of mankind, conqueror of death and saviour, the martyr who gives himself up in vicarious atonement, who dies and rises from the grave to give life eternal to all who believe in him.

In this sense Augustine is perfectly right when he claims that Christianity is not a new-fangled religion but existed from the beginning under other names. He goes as far as to declare that *pileatus* (i. e., the cap-wearer, Mithras) is but another name for Christ, and so are all the pagan saviours, Æsculapius and Dionysus, Orpheus, the ancient Baal of Tyre and Bel Marduk, Osiris and even the American Hiawatha—all are parallel formations of the Christ of Christianity.

It is wrong to speak (as does Schiller) of "the plaesure" we take in seeing tragic subjects on the stage. We ought not to use the word "pleasure," we ought rather to speak of the "satisfaction" which it affords to the spectators to witness a tragedy. It is not pleasure in the common sense of the word; it is the satisfaction of an intensely spiritual want, and this want is of a religious nature. Schiller means "satisfaction" and proves in his poetical compositions that he understood the problem in spite of the misnomer of his explanation.

Prof. Calvin Thomas, on another page of this number of *The Monist,* rightly calls attention to the fact that in a more primitive state of culture man not only took delight in the performance of tragedies on the stage, but rejoiced in witnessing the infliction of actual torture in the ritual of

sacrifices; and we must bear in mind that the goat is a mere substitute for a human Dionysus, as much as the bull, the ram, the boar and other sacrificial animals symbolize the gods whose emblems they are. The Indians were proud of the prowess displayed by the victims of the sun-dance; they claimed that the Great Spirit too looked down upon them with admiration and was pleased that his children could stand such torture without wincing.

All true art is of a religious nature; so above all is the drama, and the highest drama will always remain the tragedy. It will always represent the destiny of the man who walks on the heights of life, who becomes implicated in evil, struggles, suffers and is defeated, yet in spite of his defeat his ideal conquers. Struggle, death and resurrection or apotheosis are the essential elements of the tragedy, not in the literal but in the symbolical meaning of these words, in the sense that every man constantly and unavoidably experiences these phases in his spiritual growth.

Art represents life, and every piece of art reflects a world-conception, a philosophy, a religious conviction. Since struggle, death, and a renewal of life on a higher plane are the characteristic features of life, a truly thoughtful man will naturally find a satisfaction in witnessing the performance of a tragedy.

Suffering has been a part of religious ceremonies the world over, and it is only within historical times that civilized governments have suppressed rituals of this kind. Among savage races Miss Alice C. Fletcher was present at the last performance of the sun-dance ritual among the Indians, and her detailed report can be seen in the Smithsonian Reports.

From time immemorial the Khonds, a Dravidian race in the interior of India, in Bengal and Madras, have offered, often annually, in some districts every third year, human sacrifices to the earth goddess, called Zakaree-

Pennu, or Tari-Pennu, or Bera-Pennu, or Thadha-Pennu. The victim called *meriah* had to be purchased, unless he was born a *meriah*, by being the child of a former victim, or had in childhood been devoted to this sad fate by his father or guardian.

The details of the sacrifice differed in different districts, but everywhere the victim was cut to pieces, and the slices were mixed with the seed grain or buried in the soil of the different fields. There are quite a goodly number of various descriptions extant. We quote Mr. Russell's report on the districts under his control of the year 1837:[1]

"The ceremonies attending the barbarous rite [Khond human sacrifice] vary in different parts of the country. In the Māliahs of Goomsur, the sacrifice is offered annually to Thadha Pennu, under the effigy of a bird intended to represent a peacock, with the view of propitiating the deity to grant favorable seasons and crops. The ceremony is performed at the expense of, and in rotation, by certain *mootahs* [districts] composing a community, and connected together from local circumstances. Besides these periodical sacrifices, others are made by single *mootahs*, and even by individuals, to avert any threatening calamity from sickness, murrain, or other causes. Grown men are the most esteemed [as victims], because the most costly. Children are purchased and reared for years with the family of the person who ultimately devotes them to a cruel death, when circumstances are supposed to demand a sacrifice at his hands. They seem to be treated with kindness, and, if young, are kept under no constraint; but when old enough to be sensible of the fate that awaits them, they are placed in fetters, and guarded. Most of those who were rescued had been sold by their parents or nearest relations, a practice which, from all we could learn, is very common.

[1] Edgar Thurston's *Omens and Superstitions of Southern India*, pp. 199-201.

Persons of riper age are kidnapped by wretches who trade in human flesh. The victim must always be purchased. Criminals, or prisoners captured in war, are not considered fitting subjects. The price is paid indifferently in brass utensils, cattle, or coin. The *zanee* [or priest], who may be of any caste, officiates at the sacrifice, but he performs the *poojah* [offering of flowers, incense, etc.] to the idol through the medium of the *toomba,* who must be a Khond child under seven years of age. This child is fed and clothed at the public expense, eats with no other person, and is subjected to no act deemed impure. For a month prior to the sacrifice, there is much feasting and intoxication, and dancing round the *meriah,* who is adorned with garlands, etc., and, on the day before the performance of the barbarous rite, is stupefied with toddy, and made to sit, or, if necessary, is bound at the bottom of a post bearing the effigy above described. The assembled multitude then dance around to music, and, addressing the earth, say 'Oh! God, we offer the sacrifice to you. Give us good crops, seasons, and health.' After which they address the victim. 'We bought you with a price, and did not seize you. Now we sacrifice you according to custom, and no sin rests with us.' On the following day, the victim being again intoxicated, and anointed with oil, each individual present touches the anointed part, and wipes the oil on his own head. All then proceed in procession around the village and its boundaries, preceded by music, bearing the victim on a pole, to the top of which is attached a tuft of peacock's feathers. On returning to the post, which is always placed near the village deity called Zakaree Pennu, and represented by three stones, near which the brass effigy in the shape of a peacock is buried, they kill a pig in sacrifice, and, having allowed the blood to flow into a pit prepared for the purpose, the victim who, if it has been found possible, has been previously made senseless from

intoxication, is seized and thrown in the bloody mire amid the noise of instruments. The *zanee* then cuts a piece of flesh from the body, and buries it with ceremony near the effigy of the village idol, as an offering to the earth. All the rest afterwards go through the same form, and carry the bloody prize to their villages, where the same rites are performed, part being interred near the village idol, and little bits on the boundaries. The head and face remain untouched, and the bones, when bare, are buried with them in the pit. After this horrid ceremony has been completed, a buffalo calf is brought in front of the post, and, his forefeet having been cut off, is left there till the following day. Women, dressed in male attire, and armed as men, then drink, dance, and sing round the spot, the calf is killed and eaten, and the *zanee* is dismissed with a present of rice, and a hog or calf."

Col. Campbell[2] writes: "One of the most common ways of offering the sacrifice in Chinna Kimedi is to the effigy of an elephant (*hatti mundo* or elephant's head) rudely carved in wood, fixed on the top of a stout post, on which it is made to revolve. After the performance of the usual ceremonies, the intended victim is fastened to the proboscis of the elephant, and amidst the shouts and yells of the excited multitude of Khonds, is rapidly whirled round, when, at a given signal by the officiating *zanee* or priest, the crowd rush in, seize the *meriah,* and with their knives cut the flesh of the shrieking wretch so long as life remains. He is then cut down, the skeleton burnt, and the horried orgies are over. In several villages I counted as many as fourteen effigies of elephants, which had been used in former sacrifices. These I caused to be overthrown by the baggage elephants attached to my camp in the presence of the assembled Khonds, to show them

[2] *Personal Narrative of Service among the Wild Tribes of Khondistan,* 1864.

that these venerated objects had no power against the living animal, and to remove all vestiges of their bloody superstition."

A hymn, sung during the passion of the victim, is preserved by Risley in *The People of India,* p. 62 (1908) which, reduced to a metric version, reads thus:

"As the tears stream from thine eyes,
So may rain in August pour;
As drips mucus from thy nose
So may drizzles sometimes come;
As thy blood is gushing forth,
So may vegetation sprout;
As thy gore falls down in drops,
So the grains of rice may form."

Col. Campbell also describes a *meriah* sacrifice of the Khonds of Jeypore:

"It is always succeeded by the sacrifice of three human beings, two to the sun in the east and west of the village, and one in the center, with the usual barbarities of the *meriah.* A stout wooden post about six feet long is firmly fixed in the ground, at the foot of it a narrow grave is dug, and to the top of the post the victim is firmly fastened by the long hair of his head. Four assistants hold his outstretched arms and legs, the body being suspended horizontally over the grave, with the face toward the earth. The officiating *junna* or priest, standing on the right side, repeats the following invocation, at intervals hacking with his sacrificing knife the back part of the shrieking victim's neck. 'Oh! mighty Manicksoro, this is your festal day. To the Khonds the offering is *meriah,* to the kings *junna.* On account of this sacrifice, you have given to kings kingdoms, guns and swords. The sacrifice we now offer you must eat, and we pray that our battle-axes may be converted into swords, our bows and arrows into gunpowder and balls; and, if we have any quarrels with other tribes, give us the victory. Preserve us from the tyranny of kings and their officers.' Then addressing the victim, 'That

we may enjoy prosperity, we offer you as a sacrifice to our god Manicksoro, who will immediately eat you, so be not grieved at our slaying you. Your parents were aware, when we purchased you from them for sixty rupees, that we did so with intent to sacrifice you. There is, therefore, no sin on our heads, but on your parents. After you are dead, we shall perform your obsequies.' The victim is then decapitated, the body thrown into the grave, and the head left suspended from the post till devoured by wild beasts. The knife remains fastened to the post till the three sacrifices have been performed, when it is removed with much ceremony."

When the cruel custom was officially abolished by the British government in 1852, the Khonds demanded the privilege of sacrificing buffaloes, monkeys, goats or other animals as they had formerly sacrificed human victims. At the same time they insisted that they should be allowed to denounce in their prayers with impunity the government in general, and some of its servants in particular, as the guilty party for their deliquency in the performance of their religious duties which they considered both indispensable and sacred.

In spite of the seriousnesss with which the British government has stopped these barbaric rituals, the idea of the need and meritoriousness of human sacrifices still haunts the minds of the people, and there have been repeated occurrences which indicate that now and then sacrifices are still attempted or even actually take place, the vestiges of which are as much as possible concealed from the police.

We here quote the testimony of a case that was judged in the courts of the Bellary district in 1901. The man had offered his son as a sacrifice in the temple, but was apprehended by the police and imprisoned. The record of the Sessions Judge reads as follows:

"The prisoner has made two long statements to the magistrate, in each of which he explains why he killed the child. From these statements it appears that he had been worshiping at the temple of Kona Irappa for six or seven years, and that, on one or more occasions, the god appeared to him, and said: 'I am much pleased with your worship. There is wealth under me. To whom else should it be given but you?' The god asked the prisoner to sacrifice sheep and buffaloes, and also said: 'Give your son's head. You know that a head should be given to the god who confers a boon. I shall raise up your son, and give you the wealth which is hidden under me.' At that time, the prisoner said to the god: 'I have only one son. How can I give him?' The god replied: 'A son will be born. Do not fear me. I shall revive the son, and give you wealth.' Within one year the deceased boy was born. This increased the prisoner's faith in the god, and it is apparent from his own statement that he has for some time past been contemplating human sacrifice. He was advised not to sacrifice the son, and for a time was satisfied with sacrificing a buffalo and goats, but, as a result, did not succeed in getting the wealth that he was anxious to secure. The prisoner says he dug up some portion of the temple, but the temple people did not let him dig further. The boy was killed on a Sunday, because the prisoner says that the god informed him that the human sacrifice should be on the child's birthday, which was a Sunday. The prisoner mentions in his statement how he took the child to the temple on the Sunday morning, and cut him with a sword. Having done so, he proceeded to worship, saying: 'I offered a head to the bestower of boons. Give boons, resuscitate my son, and show me wealth.' While the prisoner was worshiping the god, and waiting for the god to revive his son, the *reddi* (headman) and the police came to the temple and interrupted the worship. The prisoner

believes that thereby the god was prevented from reviving the son.... The facts seem to be clear. The man's mind is sound in every respect but as regards this religious delusion. On that point it is unsound."

It would be difficult for a judge of India to regard a man who sacrifices his own son in any other light than as religiously insane, but we ought to bear in mind the parallel case of Abraham's intended sacrifice of Isaac as recorded in the Bible, Genesis xxii.

In reading the accounts of the stories of human sacrifices which extend down to our present day, the significance of Christianity will be clearly seen in having once for all done away with the idea of human sacrifice, but we will point out that the abolition of human sacrifice has not been accomplished by a public declaration of the uselessness of such sacrifices, but by recognizing as it were the justice of the underlying idea, and by claiming that in Christianity this indispensable need of mankind in the interest of salvation through vicarious atonement has been fulfilled in the sacrificial death of Jesus on the cross, and we must remember that every mass represents symbolically the sacrificial offering of the host.

Death on the cross was originally an offering to the sun, and it is noteworthy that in the language of the Septuagint, the Greek version of the Old Testament, the word "to crucify" is translated *exeliázein,* which means "exposing to the sun." A sacrifice to the sun is either performed by burning the victim, "making it pass through the fire," which act is commonly called in Greek *holocaust,* i. e., a burning up of the whole; or it is done by crucifixion, i. e., by allowing the sun to suck out, as it were, the life of the victim. These sacrifices prevailed most among the Semites from whom the Romans adopted them, and it was a common belief that they were considered as most efficacious. Judging from ancient tradition, God could not

refuse to grant fulfilment of a prayer if the the victim was a son of the supplicant.

In this sense we must read the passage in 2 Kings iii. 26-27, in which the king of Moab when hard pressed by the Israelites burned his eldest son, who was to have reigned in his stead, for a burnt offering upon the wall in full sight of the besieging enemy. After the sacrifice of the king's own son the Israelites abandoned the siege, despairing of taking the city.

According to the interpretation of two Roman Catholic archeologists[3] we must read a remarkable description of a sacrificial crucifixion in the history of Carthage in the same light as the story of the king of Moab who sacrificed his own son as a holocaust. The Roman historian Justinus tells us in his epitome of the Philippic histories of Trogus Pompeius that Maleus, a Carthaginian general, suffered a defeat and was exiled by the authorities of Carthage. He had been victorious and had sent the tenth of the booty home by his son Carthalo, who was thence despatched to offer it as a gift to the Tyrian Hercules at Tyre in Phenicia, the metropolis of Carthage. Indignant about the treatment Maleus had received at the hands of his compatriots, the Carthaginian general did not go into exile but returned home with the whole army to take revenge. While he was besieging the city, his son Carthalo returned from Tyre adorned with purple and priestly insignia. Having first attended to his religious duties in the temple, Carthalo met his father who bitterly reproached him for his lack of filial piety and had him crucified in his priestly robe on a high cross in sight of the besieged city. A few days afterwards he succeeded in conquering Carthage and took revenge on the authorities by having ten senators slain and himself reinstated. The triumph of the

[3] Von der Alm in *Theologische Briefe*, III, p. 138, and following him Dr. J. Stockbauer in *Kunstgeschichte des Kreuzes*, p. 3.

cruel father did not last long. Since he was suspected of striving for royal power the enemies of Maleus recovered their influence. They accused him of slaying his son and fighting against his country, whereupon he was condemned and executed.

Here we have another conspicuous instance of a human sacrifice, and if the interpretation of Von der Alm and Stockbauer may be trusted, we must assume that one who sacrifices his own son as an offering on the cross expects to attain the fulfilment of his wish from Baal.

There is no need of multiplying instances of a belief in the efficacy of a sacrifice of one's own son. They can be found in folklore all over the earth, and facts of a kindred nature have been gathered by Professor Frazer in his famous book *The Golden Bough*. We have the cruel rites of human sacrifices in ancient Mexico and in addition the wide spread custom of theophagy, the ceremonial eating of the god.

The most essential feature of life is the truth that the maintenance of life is a constant struggle and its end is death. The fittest survive, and the fittest are those who gain advantages through the love and sacrifice of their parents and fellow beings. We live through sacrifice, and through continued sacrifice the human race rises higher and higher. In this sense life is and will forever remain a tragedy. The climax of the struggle need not lead to actual death, but it must always involve suffering and tribulation; the main point is that tragedy means a victory through sacrifice.

In the light of this fact we can understand how Aristotle could see in a tragedy the most perfect expression of art, and also how religion from its most primitive stage up to the highest summit of its development should be a more and more refined presentation of a tragedy.

The truth that life is a tragedy is a common occurrence in experience, and progress is made through sacrifice. This has been true for all times and is true to-day, but in former days when life was governed more by superstitious notions the tragic events were more dramatic, and this can be seen in countries which are not yet so far advanced as we are wont to see in modern European and American cities.

As an instance which fully expresses the meaning of this truth I will quote here an incident of modern Hindu life: It is well known that girls are considered a burden in India because the religious traditions of orthodox Hinduism demand that girls should be married at a definite age, and it has become an established custom that the bridegroom must be bought. This custom has been taken advantage of by ambitious youths who thus gained a means of acquiring a higher education. The educated youth having a chance of earning a better living is in high demand, and parents are compelled by religious usage to dispose of their daughters. The bridegrooms frequently stipulate not only the payment for their education but also further sustenance in the first years of married life to continue to complete their studies. This nuisance has contributed to the impoverishment of many families who in their religious fervor wished to comply with the requirements of their orthodox faith. It was for this reason that the infanticide of girl babies was practised in India, and it happened of late that a girl by the name of Snehalata ("the creeper of affection") was to be married to a bridegroom for whom the parents-in-law had to pay a price of 1800 rupees, and 1200 rupees worth of jewels. These expenses were too hard on the family, and in order to free her parents from the crushing debt involved by her marriage the girl decided to sacrifice herself for the benefit of the family. She burned herself to death and the touching letter which she left behind reads as follows (see *Open Court,* July 1914):

"Father, I have heard that many noble-hearted and educated young men volunteered for philanthropic work for the relief of the sufferers from the Burdwan floods. God bless their kindly hearts, so full of compassion for their suffering fellow-beings. I have also heard that many young men have taken a vow not to buy *bideshi* (foreign) articles. Only the other day I heard how bands of noble-minded youths had gone from door to door to raise funds for the relief of some people in far away South Africa. But is there no one among them to feel for their own people?

"Last night I dreamt a dream, father, which made me take my vow. To the enthralling strains of a music unheard before, and amid a blaze of light as never was on land or sea, I saw the Divine Mother Durga, with benignant smile, beckoning me to the abode of the blest, up above, and then I thought of you father, of the ever sorrow-laden face of my beloved mother and of the dear little ones who have done so much to brighten our home. And then I resolved to save you all and made a sign to the Divine Mother that I would not delay obeying her merciful call.

"After I am gone, father, I know you will shed tears over my ashes. I shall be gone—but the house will be saved. Since then I have been pondering on the best way of ending my worldly pilgrimage—fire, water, or poison. I have preferred the first, and may the conflagration I shall kindle set the whole country on fire!"

The event has stirred India and the movement started through the excitement has produced among other good results the foundation of a society of Indian youths who take the vow not to accept any "bridegroom price" on account of their marriage. Here is a glaring instance of a sacrifice done for a purpose, a sacrifice which is sure to

bring good results, and little Snehalata is worthy to be mentioned among the heroes and martyrs of mankind.[4]

The Christ-conception existed before Christ and has had its influence on the dogmatic interpretation of the life of Jesus. Whether or not Jesus was a historical person is a question of passing interest, for the superpersonal figure of the Christ ideal is the founder of Christianity, not St. Paul nor Jesus the Nazarene; and it is certainly not a mere accident that we do not speak of Jesuanity but of Christianity.

In comment on the theory of the non-historicity of Jesus, so doughtily advanced by Prof. William Benjamin Smith of Tulane University, and again championed in the present number of *The Monist* by Mr. K. C. Anderson (who, however, strange to say, makes no reference to him) we wish to say that we can not be convinced of the negative aspect of their views, the non-existence of Jesus, although we fully accept the positive claim that Christ, not Jesus, is the formative factor of Christianity.

In connection with a discussion of the Christ problem, a few comments will be in order on Mr. Kampmeier's article "Are We Just to Jesus?" which is published in the current number of *The Monist,* and we must say in justice to the author and in explanation of the motive that instigated him to treat this subject, that the article is practically a criticism of my own view upheld in editorials. In a personal letter to Mr. Kampmeier, I descanted on the proposition that for any essential questions, and also for practical purposes, it was quite indifferent whether or not Jesus had lived or of what character he may have been.

Christianity originated through syncretism. The ideal of Christ existed before Jesus, and it is the ideal of Christ and not Jesus that has become the founder of Christianity.

[4] Incidentally I wish to call attention to the story of *The Chief's Daughter,* describing the last sacrifice of the Niagara Indians, and treating the subject in this spirit (Open Court Publishing Co., 1901).

Ideals (i. e., superpersonalities) need not be historical persons. They are heroes or gods and their efficiency is greater than historical persons. It is probable that Dr. William Benjamin Smith means in his proposition that Jesus is a god, and only a god, not a man, the same as we mean by a superpersonality.

The main portion of my letter to Mr. Kampmeier criticized by him in his article contains the following expositions:

First of all I recognize plainly that the Gospel stories of Jesus contain much material which is not of a historical origin. We find in them traces of sun myths; incidents of the lives of previous saviours have been superadded upon Jesus; ideas of a Christ which were prevalent at the time, have been introduced as historical facts; finally sayings attributed to former saviours or Buddhas are ascribed to Jesus, and so we find innumerable references to parallel formations in other religions. All these items have been used as evidence to prove the non-historicity of Jesus. What they really prove is that an ideal was prevalent among the nations which we may call the ideal of a Christ, a Messiah, a Buddha, a Mithras, a Jaina, a god-man, a divine incarnation, etc. I have no doubt that books existed which contained the sayings of a divine teacher, and they were derived most likely from Indian sources, containing many Buddhistic ideas. Such must have been the book used in the synoptics, called "Q" by Wellhausen.

The idea that Christ was not historical seems to suggest itself, but there are remnants left which do not agree with this Christ-ideal, and stand even in contradiction to the traditional notion of the Greek Christ-ideal as it prevailed among the Gentile Christians. These little remnants of an Aramaic personality indicate that there is an element in the Gospels which has little to do with the Christ-ideal, and

seems to be the underlying and historical root upon which all the rest has been grafted.

In the synoptic Gospels Jesus is a healer. Apparently he made a living by healing. He is a fanatic in his way, and certainly not the gentle Jesus of the Unitarians, the liberals among the higher critics, or the historicists. He could curse a fig-tree simply because it did not bear fruit when he wanted a fig, and that when the time of figs was not yet. The Jesus of Mark let loose a legion of demons in Gadara where they hurled a herd of swine into the sea. He could curse his adversaries, the scribes and Pharisees, in a sweeping and wholesale condemnation. Even granting that most of the scribes and Pharisees were hypocrites, we need not doubt that there were among them many pious people; but they were as much his enemies as the physicians are the enemies of mind-cure healers and Christian scientists to-day. He, the traveling healer, interfered with their profession of supervising the hygienic conditions of the people and their business of pronouncing on the health of lepers, etc.

Moreover this historical Jesus must have been a Jew of the narrowest kind, for he called the Gentiles dogs,—an expression in Matthew xv. 26, smoothed down, probably by a Gentile copyist's hand, to "lap dogs" or "little dogs,"[5] a pet name, not "dogs."[6] He also declared in Matthew v. 18 that "Till heaven and earth pass, one jot or one tittle shall in no wise pass" from the Mosaic law.[7]

The passage which mentions the brothers and sisters of Jesus[8] can only by very artificial means be interpreted as

[5] *κυναρίοις.*

[6] *κυσίν.* Compare Matt. vii. 6, where "dogs" can only refer to the Gentiles.

[7] That must have been the original meaning of this well-known contradictory passage. The second clause "till all be fulfilled" is apparently a later addition. The Mosaic law had been abolished because (as St. Paul argued) it had been fulfilled.

[8] Mark iii. 31-35.

having a symbolic meaning. Here we have scriptural evidence of his family, and we have reason to believe that he did not live in concord with his mother and his brothers and sisters, for he refused to see them.

There are further indications of a concrete background not in accord with Gentile tradition, and I will mention a few of them. The existence of Nazareth seems doubtful. There is a confusion between Nazaree, the member of a sect, and Nazarean, meaning the man from Nazareth. The early Christians and St. Paul are called Nazarenes, although they were not born in Nazareth. The argument that Nazareth as a town does not make its appearance before the fourth century is well known, and it is more than probable that the home of Jesus was Capernaum. At any rate Capernaum was called "his city."

The apostle Paul never met Jesus, but he knew his brother James and other disciples, especially Simon, called Cephas or Peter. Why should the expression "brother" be symbolical as Dr. Smith claims? There is no probability that the quarrels between Peter and Paul should be later inventions of a symbolical nature, for we must bear in mind that the pact between Peter and Paul to divide the world between them makes the story of Peter's journey to Rome and his becoming the first bishop of Rome, if historical, a palpable breach of faith.

The life of Jesus was apparently passed in the province of Galilee, and if we ignore the story of his visit to the temple in his childhood, he seems to have come to Jerusalem only once when he was seized and crucified.

All his sayings give not the slightest indication that he busied himself with the political problem of his people. He thinks of their immediate ailments and diseases. The passage concerning Cæsar's imprint on the coins does not make the impression of being a historical incident. It was probably a later invention to make Christianity acceptable

to the Roman government, for the meaning of the incident seems to characterize the later situation.

It stands to reason that when Jesus came to Jerusalem he offended on both sides, the priests or orthodox Jews who never cared much for Galileans, and the Romans who naturally would see in him a dangerous rebel.

According to tradition in Mark Jesus was very impulsive, and possibly a fanatic Nazarene sectarian. If the Nazarenes were actually the same sect as the Essenes, he must have been opposed to bloody sacrifices and this would explain his wrath when entering the temple. Did his words perhaps imply an objection to the slaughter of animals when he said: "Is it not written, My house shall be called the house of prayer? but ye have made it a den of thieves?"

The original[9] here means "a den of robbers or pirates or buccaneers," viz., men who kill to rob. Luther translates *Mördergrube*. If Luther's version is correct the story acquires a definite meaning and the narrative of the purging of the temple may be based upon an actual occurrence, which would naturally make many enemies, not only among the venders of doves themselves, and the money changers and the orthodox Jews, but also among all those common people who were in business contact with the traders at the temple gate.

The stories of the crucifixion are apparently modified through the principle not to cast any blame on the Roman authorities. There was a time when Christianity endeavored to ingratiate itself with Rome. Paul prides himself on being a Roman citizen and finally Roman Christianity against the faiths of the Armenians and Copts became its orthodox form. Yet it is clear that Jesus was not crucified by the Jews upon whom the opprobrium of the deed is thrown, but by the Romans, and so Pilate is represented as a weak man who became a mere instrument in the hands

[9] σπήλαιον λῃστῶν.

of the highpriests. Yet we ought to take note that Pilate had no right to sit in judgment in Jerusalem. Jerusalem stood under the jurisdiction of Herod, except perhaps, as probably was the case at the time of feast, when martial law was pronounced.

The prophecy that people standing by would live to see Jesus come in the heavens with all his glory is an irrefutable proof that the passage is old and genuine.[10] It must have been written in the first century, and has not been removed as unfulfilled. It is another indication that the Gospels contain at least a nucleus of genuine old traditions.

Thus I base my views of the historicity of Jesus mainly on those passages which would not have been written if Jesus had been a mere ideal figure constructed for the sake of symbolization or as an incorporation of an old sun myth, or a new formation of a divinity of some kind or a belief in a saviour-god, or a Yahveh cult, or a kind of Judaized Buddhism. The original documents must have been based on genuine records of a real man, although the essentially Christian elements (viz., those narratives which are typical of saviour stories) as well as the sayings of a religious sage, the parables, the Lord's prayer, the beatitudes, the Logia in the "Q" document, etc., may have been superadded in the course of the development of the New Testament scriptures.

* * *

While I believe that Christianity has been called rightly after Christ and not after Jesus, Mr. Kampmeier recognizes Jesus as the founder of Christianity and thinks that the church would not have originated without the man Jesus. But the New Testament itself furnishes the evidence that it was St. Paul who identified the two. We read in the Acts (xviii. 24) that there was a teacher called

[10] The same argument has been used by Schopenhauer and is likewise considered irrefutable by Garbe. See his article in the present number.

Apollos who "taught diligently the things of the Lord," which is the typical expression for the Christ, the religious ideal of the God-man whom the Jews called Messiah and the Gentiles the Saviour.[11] Apollos was perfectly familiar with the Christ-ideal, but he had never heard of Jesus, and the Gospel which Paul preached consised in this, that this Christ had become flesh in Jesus, and Paul succeeded in having Jesus recognized as the Christ. In this sense and in this alone Paul may be regarded as the founder of Christianity.

Why Jesus was better than any other figure to be identified with the highest religious ideal of the age need not be discussed here. We must assume that the humanity of Jesus and his martyr's death were more sympathetic to the down-trodden multitudes of the Roman empire than the more philosophical figure of Apollonius of Tyana and the mythological personality of a Mithras. But we claim that some other figure might have taken the place of Jesus, in which case the narratives of a saviour, of an ideal teacher, of a healer, of a conqueror of death, etc., would have crystallized about this other person in the same way as in the development of Christianity they have crystallized around Jesus.

This view is naturally regarded by men like Mr. Kampmeier as an underestimation of Jesus, and so he has felt called upon to explain his position and give his answer to the question "Are we just to Jesus?" His opinion represents an important phase in the conception of the Christ-ideal most prevalent among the Unitarians and other liberal Christians, and so we feel that in order to complete the discussion of the Christ-ideal his view should not be overlooked.

While we believe that the Christ-ideal, the superper-

[11] The term σωτήρ is Greek, not Jewish; the very word does not exist in Hebrew.

sonality of a saviour and not the human personality of Jesus, has made Christianity and has always remained its backbone, we see no necessity of denying the historicity of Jesus. Occam's razor, as Prof. W. B. Smith argues, can no more cut it off than M. Pérès's ingenious proposition of the Apollo incarnation of Napoleon will render Buonaparte unhistorical or as the poem of the Alexander myth will change Alexander the Great into a mere solar hero. The amalgamation of myth and history is too common to see in it anything improbable or even impossible.

I wish to add one suggestion which may be helpful for the interpretation of the facts of our religious development. Superpersonalities, such as ideals, gods and religious aspirations; heroes, such as Heracles in ancient Greece; also the figures of great men (not what they were in life but what became of them after death) such as Bismarck, Washington, Napoleon, etc., are not nonentities, but important factors in the life of mankind. The thought of Heracles was not a mere fable to the Greek youth but a potent influence which moulded his life, and so the Christ-conception of to-day is and has been since the beginning of the Christian era, a living power in the Christian churches. We must learn to appreciate the superpersonalities of secular life as well as of the gods of pagan religions by recognizing the paramount influence which such ideals exert in the life of the people.[12] This is true of Christ and also of the analogous pagan notions, although we now find difficulty in appreciating their significance. Only if we compare pagan sentiments to the sentiments which Christians entertain for Christian beliefs, shall we catch glimpses of the truth.

We see a lesson in the struggle for the historicity or non-historicity of Jesus, which is this. The liberal party

[12] Concerning the nature of "superpersonalities" see the writer's little book *Personality With Special Reference to Superpersonalities and the Interpersonal Character of Ideas*, Chicago, 1911.

of theology has succeeded in breaking down the claims of the old orthodoxy, but the liberals have gone too far. In attacking the letter of dogma and tradition they have denied the spirit. As a rule they do not understand the meaning of the religion whose beliefs they attack. So it is natural that they see in Jesus a mere man; they deny his divinity. All their hope is therefore set in the human Jesus. Jesus has been stripped of all supernatural qualities, he remains to them a mere man. He is good, indeed very good. He is a paragon of virtue, a veritable model of Sunday-school morality, and this is expressed by calling him "the gentle Jesus" or honoring him with similar names. He is not a God, not a superpersonality, but an ideal man, and he is assumed to be the founder of the church. The orthodox position is rejected as irrational, impossible and superstitious. To these liberals it is sufficient to prove the Christ figure to be mythological.

Now we will unreservedly grant that Christ is a mythological figure; and all that the Mediterranean people ascribed to a saviour—the virgin birth, the power to perform miracles, a blameless character, the fate of martyrdom, of suffering and dying for others, the resurrection from the tomb and an apotheosis in one form or another, all the wisdom of the ages—was attributed to him as a matter of course. Such is the logic of a religious mind. This is the way in which a believer argues. It is founded in the constitution of a man's being that a saviour must have sacrificed himself for the good of mankind, therefore Christ's death was an act of vicarious atonement.

Here is an instance of how the scriptures grew by accretion: A Christian hears that when Socrates died he forgave his enemies. A pagan may have argued, "You see Socrates was nobler than Christ." But the Christian thinks: "Christ was the ideal man, therefore he can not have been outdone by Socrates; he too must have forgiven

his enemies." The passage in Luke xxiii. 34 does not occur in the oldest manuscripts but was inserted comparatively late by a copyist who was somehow familiar with Plato's Crito and had adopted this typically human argument. Once inserted, the passage remained a most highly appreciated verse in the gospel story, though no critical student of the New Testament will venture to regard it as historical.

We read of Zarathustra and of Bodhisattva that they were tempted by the Evil Spirit before they started on their careers. Great moral teachers must first have proved that they knew the nature of evil and that they could overcome the tempter. Therefore Jesus must have been tempted.

We need not increase instances to explain how ideals grow and how they naturally develop by incorporating what is kin to them and assimilating what by slight changes can be adapted. And ideals are predetermined in the constitution of being like Platonic ideals, like the types of the several atoms, like the chemical compounds, predetermined in their nature, and also like plants and animals and rational beings. We are sure that the atoms of gold are the same on earth as in the sun and in the stars of distant worlds. So we can be sure that the same law will develop similar organisms in the most distant planets, and the moral leaders of a group of rational creatures will teach the same ethics of universal good-will as all the abstract thinkers will invent the same geometry however different may be their roads of approach or methods of demonstration or schemes of explanation. So the ideal of a Christ is not only predetermined by the history of the people where the story of a saviour grows, but is also founded, at least in general outlines, in the conditions of the social life of rational beings. Thus a Christ can rightly

say: "Before Abraham was I am." In fact the ideal man, as an ideal, existed in the beginning of the world and it was with God. It is as eternal as God and is the divine factor which determines the development of life toward the realization of the Christ ideal.

We see that the orthodox view contains a truth which no higher criticism can kill. The construction of an ideal man, such as the gentle Jesus of liberal theology will scarcely be verified by historical investigation, and in our opinion it is quite indifferent for us to-day what Jesus thought and did and whether he was as gentle as described in Unitarian tractates or whether he was as zealous and stern as the Jesus according to Mark who expels demons, commands the storm and allows a herd of two thousand swine to drown, forbids his disciples to approach the Gentiles and the Samaritans, consigns Dives to hell, requires the rich youth to sell all he has and give to the poor, curses the fig-tree, scourges the money changers from the temple gates, expels other poor venders peddling pigeons etc. If we want to render the Gospel story useful for us to-day, we must reinterpret it in the spirit of to-day and must explain the incidents of the life of Jesus in the light of the Christ-ideal which we have to-day.

One thing seems assured. The Christ-ideal of the church is not the Jewish Messianic ideal. It is the ideal of a healer like Æsculapius, who cures the blind and makes the lame walk again; of a teacher of ethics such as taught in the school of neo-Platonism; of a preacher such as could be found among the Stoics. Moreover this ideal was a god-man. As Hercules found comfort in the idea that he was the son of Zeus, so Jesus addressed God as his father.

Such is the Jesus of the latest Gospel according to St. John which though it may have incorporated older elements is the least historical and ranges highest in significance. Had it not been written Christianity might not

have overcome its rival religions, Gnosticism, Manicheism, Mithraism or even the belief in Apollonius of Tyana. The main factor, however, which gave strength to Christianity lies in its recognition of life as suffering, and the conquest of evil by sacrifice.

On a superficial inspection life seems a joyful display of energy, a kind of frolic entered into for the fun of it. Such is naturally the opinion of childhood and youth, but mature manhood with its struggles and cares will soon enough teach us the earnestness of life. The time will come to every one who reaches maturity of thought, when he will understand that life is a tragedy, and this lies in the very nature of thought.

Every heroism procuring reform or progress means a sacrifice of the present for the future, of the generation of to-day for the generation to come, of the life-blood of the parents for the welfare of their children, yea of the present hour for the years to come.

This is true generally, but it is specially true of the heroes of mankind who bear the brunt of the battle for progress, and so it is but natural that the quintessence of all the religions that can claim any depth of conception deal with the problem of evil and teach us to face and to overcome the tragic element in life. The North American Indian wanted to show to the Great Spirit what suffering his sons could endure and so underwent the horrible tortures of the sun dance. The Syrian Adonis, the lord, or Tamuz, personified vegetation, and his devotees witnessed his tragic death in religious mysteries. Similar ideas pervade almost all the pagan religions, and the gist of Christianity is this same world-old tale of the god who offers himself up for the best of mankind, who dies on the cross that those who believe in him may gain life everlasting.

These considerations explain Christianity as the re-

ligion of mankind and also the similarity of Christianity to the pre-Christian Gentile religions.[13]

Mankind wants and indeed needs a religion that sets forth the truth of tragedy, of our struggle with the power of evil, and of triumph over evil through sacrifice. If we understand the history of religion aright and if we study the data of comparative religion with sympathy—or, if that be grudged to pagans, merely with justice—we shall be able to trace the common basis of all faiths in the crucial truth that all life is a tragedy, and this remains true whether or not there are historical connections between the pre-Christian and Christian institutions, such as Lenten ceremonies and Easter festivals.

The recognition of this idea will remove many misgivings in the circles of those theologians whom Christ addresses with the words "Ye of little faith" and we are glad to notice that some scholars begin to understand the significance of this conception. We quote from Dr. Hugo Radau's *Sumerian Hymns and Prayers to God Dumu-zi or Babylonian Lenten Songs,*[14] (Preface, pp. vii-viii):

"Strange indeed and most remarkable are the parallels between the Sumerian and Christian Lenten and Easter festivals:

"Dumuzi goes to the 'north' or 'netherworld,' *i. e.,* he 'dies,' in order to conquer the *'enemy from the north,'* the cold, winter, darkness. Christ dies in order to conquer Satan, the 'prince of darkness.'

"Dumuzi while in the netherworld is 'bewailed' by his 'Bride' Ishtar, especially during the month February-March (*Ululu*); but this is exactly the season of the Chris-

[13] This idea is outlined in a little book entitled *The Pleroma* (Open Court Publishing Co., 1909) which is a historical account of the pre-Christian struggle for religious supremacy, and how it resulted in Christianity as the fulfilment—the *pleroma*—of the needs of the times.

[14] Published as Vol. XXX, Part I, of *The Babylonian Expedition of the University of Pennsylvania,* Munich 1913, to be obtained through Rudolf Merkel, Erlangen, Germany.

tian Lent, during which the church, the 'Bride of the Lamb,' mourns over the death of her 'bridegroom,' Christ.

"The month *Ululu* is followed immediately by the 'month of the festival of Dumuzi' which begins with the vernal equinox and which celebrates, among other things, Dumuzi's marriage with 'Mother Earth,' the resurrection of nature and the beginning of new life. The Christian lenten season is terminated by the Easter festival, celebrating at the time of the vernal equinox the resurrection of Christ and the beginning of a new, spiritual life (*zoopoietheis de to pneumati,* 1 Peter iii. 18) of Christ and of his church, thus demonstrating, corroborating and proving the truthfulness and correctness of the Sumerian resurrection festival, for 'if there is no resurrection of the dead, neither hath Christ been raised' or again 'if the dead are not raised, neither hath Christ been raised' (1 Cor. xv, 12ff).

"The Christian lenten and resurrection festivals are in this wise by no means merely a 'rehash' of Babylonian ideas. This would be misunderstanding the divine will as carried out in history. No, not a 'rehash,' but the very culmination and 'fulfilment' of the wisdom of ages past are the Christian lenten and resurrection festivals. The 'truth' which the Sumerians dimly recognized while still groping in the dark receives by the death and resurrection of Christ its true light, explanation, seal, approval and spiritual significance. Christ and the Christian religion not only *is,* but *must* and, I am sure, *will* be recognized, more and more, to be what we are told it is: the *pleroma.*

"In thus admitting, on the one hand, the exact parallels between the Sumerian and the Christian lent and resurrection, and on the other recognizing in the Christian festivals the *pleroma* of their predecessors among the Sumerians, we will not stand in any danger of losing our faith—on the contrary, the Christian religion will become for us

a living reality, the last link in the long chain of divine revelations uniting us with the past and into a common brotherhood of man, believing the same thing and hoping for the same thing: *our own resurrection.*

"Let us, therefore, be true to ourselves and recognize the divine element even in the Sumerian religion, at the same time let us not forget that grand and sublime though the Sumerian religion may be, it is but a faint shadow of the light that shines in Christ. This 'declaration of faith' I am constrained to make publicly here in response to several communications and criticisms from certain quarters requesting me to state frankly and honestly my position and *personal belief* with regard to the Sumerian religion in its relation to that of the Christians."

Here is our conclusion: The tragedy of Golgotha is the most characteristic and the most essential trait of Christianity, and still to-day we recognize the truth that every enhancement of life, every progress, the widening of our horizon in politics, in social life, in the discovery of truth, even in industrial enterprises, yea the mere maintenance of life and its continuance in the future generation, the rearing of children and their education can be accomplished only through sacrifices. Life is a constant struggle: we fight and bear the brunt of the battle, we are perhaps wounded; we break down under the burden of toil and if the cause for which we fight be victorious, others, not we, will see the day of triumph; we pass away but mankind marches on. Such is the nature of the tragedy, such is the meaning of Christianity and such is the destiny of mankind.

EDITOR.

ARE WE JUST TO JESUS?

THERE seems to be a tendency, as I recently found out through a correspondence with the editor of *The Monist,* among those who, for good historical reasons, can not accept the complete denial of the historicity of Jesus, to undervalue the character of Jesus and his importance for the origin of Christianity. Though the writer sees in Jesus only a human character and therefore not a perfect ideal man, he thinks for this very reason that we ought to judge the character of Jesus and his importance for the origin of Christianity as justly as possible. We must take into full consideration the times, surroundings and education which brought him forth, and also see whether there was not something after all in his character which made it possible that a world-religion could be attached to his personality.

There are several points in the character and work of Jesus which are not sympathetic to many a modern man and therefore have often been open to attack.

According to the Gospels Jesus was a great exorcist and healer of disease, driving out the demons in the name of God. To any one who is acquainted with the general views of antiquity on the nature of disease and with the prevailing custom among both Jews and Gentiles of healing sickness by exorcism and other means which appear to us as superstitious, the practice of Jesus is not strange at all.

Jesus does not stand alone in this respect. Other noted prophets, religious and moral teachers of antiquity, such as Epimenides, Empedocles and Apollonius of Tyana, were said to have been at the same time great healers and miracle workers. It is well known that even a Vespasian could be prevailed upon to undertake cures at Alexandria in the name of Jupiter Serapis in exactly the same way as Jesus. Jesus did not claim a monopoly as exorcist and healer among his people. He readily conceded that the disciples of his opponents, the Pharisees, also exorcised demons (Matt. xii. 27).

Of course the Gospels make Jesus the preeminently great exorcist and healer. This can be readily understood, for when primitive Christianity was pursuing its victorious way, it naturally represented its founder as the man to whom God had especially given the greatest power to overcome disease and its origin, the evil demons, just as Moses was represented as more powerful than the Egyptian conjurers. We have a striking example of this in the earliest Gospel, Mark. Here Jesus plays a greater rôle as an exorcist and wonderworker than as a religious teacher. The object of this Gospel is to awaken belief in the divine mission of Jesus by representing his great and mighty deeds. That there is much exaggeration here, as also in the other Gospels, every one will now concede. But even the Gospels are compelled to admit that the power of Jesus is not absolute where faith is lacking, showing how great a part auto-suggestion played in his work as exorcist and healer.

That Jesus was a healer should not lower him in our estimation. Even the attacks against Christianity in the first centuries by such men as Celsus and others were not directed against Jesus as healer and miracle-worker. They only disputed that his miracles were any different from those the old gods performed, and the Christian apologists

had no better way to answer this claim than by attributing to the devil the healing practised in the name of the old gods, just as the Pharisees had attributed the healings of Jesus to Beelzebub.

As long as Jesus practised the office of exorcist from pure sympathy for his fellow men (and this impression we get without doubt from the Gospels) and not for self-glory and gain, there is no reason to condemn him. The living he gained by this practice must have been very scant, for he is once reported as saying that the foxes and birds were better off than himself. Considering that man is as anxious about his health to-day as in the days of antiquity, and that the hope of securing health still plays as large a part as any other feature in the attempted construction of a religion of the future, we must be lenient when we realize that this point was predominant in the rise of a new religion in the early days of Christianity and was met by methods that were in accord with the knowledge of the times.

Another point often brought forward against the character of Jesus is his Jewish narrowness. The passage in the story of the healing of the Syro-Phenician woman's daughter is frequently cited as an illustration (Mark vii. 27): "It is not meet to take the children's bread and cast it unto the dogs." It is generally known that because the dog was considered a ceremonially unclean animal among the Jews, they often applied this term to the Gentiles to designate them as profane and unholy because they did not follow the ritualistic laws of the Jews. Whether the passage Matt. iii. 6: "Give not that which is holy unto the dogs, neither cast ye your pearls before swine," also refers to Gentiles, or is only a figurative expression referring to profane natures generally, is doubtful, since Paul, who surely cannot be accused of Jewish narrowness after his conversion, uses the term "dogs" in a figurative sense

even of "evil-workers," the Jewish-Christian teachers who demanded circumcision of the Gentile Christians (Phil. iii. 2). Reference is further made to the expressions (Matt. v. 17-18), "I am not come to destroy the law. . . ., but to fulfil," and "one jot or one tittle shall in no wise pass from the law etc."

It must be conceded that Jesus was thoroughly Jewish. Nothing else could be expected from his purely Jewish-Palestinian education. It must also be conceded that his mission was intended for his own people, for he said: "I am not sent but unto the lost sheep of the house of Israel," and when he sent out his disciples to preach, he told them not to go "into the way of the Gentiles" or "into any city of the Samaritans."

Still we must be careful not to make Jesus narrower than he was. The same Gospel (Matthew) which has taken over the story of the Syro-Phenician woman from Mark, though it has a more Judaistic tinge than any other Gospel, relates also the story of the Roman centurion who asks Jesus to heal his servant and to whom Jesus replies that he had not found so much faith among his own people, adding that many would come from the east and west and sit down with the patriarchs in the coming kingdom while "the children of the kingdom" would be cast out (Matt. viii. 11). These words compared with others of Jesus, that Tyre and Sidon, Sodom and Gomorrah would receive a more lenient final judgment, and that the repentant Ninevites and the queen of the south would rise up in judgment against his own generation, show that Jesus was inconsistently less narrow than he is assumed to have been.

Such sayings of Jesus might be construed as arising merely from dissatisfaction at his own ill success, but we must remember that they are entirely in accord with the spirit of the best Hebrew prophets who very often drew comparisons between their people and other nations favor-

able to the latter. In fact the Jewish religion, in spite of its exclusiveness, was not so narrow as we generally conceive it. Though it considered itself of a higher quality than surrounding religions, it believed its mission to be that of spreading the true knowledge of God with the firm expectation that all nations would finally accept its main truths.

That the mission of Jesus was limited to his people alone was extremely natural, and it was wise, moreover, to limit his work to a smaller sphere thus making it more effective. He evidently thought, as did the Baptist, that there was more fear for his own people at the coming of the kingdom than for others, because "unto whomsoever much is given, of him shall be much required" (Luke xii. 48).

Another arraignment often repeated against Jesus is that he intentionally destroyed other people's property, as in the case of the herd of swine of the Gadarenes, and when he cursed a fig-tree because it did not bear fruit at a time when figs could not be expected, as Mark has it (xi. 13). That Jesus intentionally destroyed the herd of swine there is not the least hint in the narrative, nor that he even expected the unlucky result, even if he believed that demons could enter animals. We of course can not believe this, nor that the demons were foolish enough, as David Strauss said, to destroy their new abode again immediately. The story is as grotesque as that of the Jewish exorcist who drove out demons in the name of Solomon before Vespasian by holding a certain root to the nose of the patient, and proved the expulsion of the demon by making him upset a basin of water placed there for that purpose (Josephus, *Ant.*, VIII, 2, 5).

Concerning the story of the accursed fig-tree it is not to be conceived that Jesus was so simple as to expect figs from a tree when figs were not due. The story is incom-

prehensible, and many think that it may have started from the parable of the barren fig-tree as Luke relates it. In regard to many things which the Gospels have reported of Jesus in their zeal and admiration of him and to show his divinity and extraordinary powers, Jesus could well have said: "God protect me from my friends, against my enemies I will shield myself."

Another point. We may readily concede that Jesus had a very impetuous nature, a trait which seems to have characterized the Galileans generally according to Josephus and certain hints in the Gospels. That he cleansed the temple (the Fourth Gospel has magnified the story by giving Jesus a whip of cords) and that he did not treat the spiritual leaders of his people with gloves, as the invectives against them when he came to Jerusalem clearly show, are probably no inventions. Very probably his first visit to Jerusalem had the same effect upon him as the visit of Luther to Rome.

There are other instances that go to show that the temple needed cleansing, though the way Jesus proceeded may not have been the wisest one. We are told in the Talmud that Simon, the son of the Gamaliel mentioned in Acts, was obliged later to effect some reforms regarding money-changing in the temple (*Ker.*, I, 7; *Sanh.*, 90b). We also have other proofs from his own times and from impartial Jewish sources that Jesus was not the first one who said harsh things against the spiritual leaders of his people, though surely not all of them.

The tract *Aboth* (Sayings of the Fathers of the Synagogue) declares that "there are seven sorts of hypocrites among the Pharisees," and describes each of them. Of one sort of Pharisees who ask, "What more is my duty?" the tract raises the question, "Why is this hypocrisy?" and goes on to state that the inquirer is boasting that he has done every good thing possible, and challenges any

one to tell him what more there is to be done and he will do it. Of another we are informed that "he walks on tiptoe in order to show his meekness and thereby to attract attention." Another is described as "One who is walking with his eyes shut in order not to look upon women, and so strikes his head against a wall and bleeds." Another "allows himself to be circumcised, not to please God but for his own benefit," which reminds us of the words in the invective (Matt. xxiii. 15): "Woe to you, scribes and Pharisees, hypocrites! for ye compass sea and land to make one proselyte, and when he is made, ye make him twofold more the child of hell than yourselves."

There is no question but the strong criticism of legalism and minute observance of the oral law which hedged in the written law was well deserved. Not to go into details in this matter as they are mentioned in the Gospels, we only refer to the summarizing words of Jesus, that all that minute observance set aside "the weightier matters of the law," "judgment, mercy, and faith."

Perhaps the character of the priestly class, which assisted in the final downfall of Jesus, was also open to criticism. The Talmud speaks of the "bazaars of Annas" (Derenbourg, *Hist. de la Palestine*), which would imply that this high-priest knew how to combine a sacred station with business. Of one of his sons of the same name, who also became high-priest, Josephus says that "he was a great hoarder of money" and that under his administration even some of the lower priests died for want of food." (*Ant.*, XX, 9, 2).

Impetuosity bursting with righteous indignation over abuses and hurling "woes" against their perpetrators, though it may often exceed proper limits, is not always the sign of a medium but of a very high character. In the history of human progress such characters have often served the very desirable purpose of a violent thunder-

storm to clear the air. The damage which a storm may cause here and there is not to be compared to the general relief and good it brings.

On the other hand every student of human history and daily life knows that stormy characters can be men of the tenderest and gentlest emotions. This was surely the case with Jesus. His sympathy with the fallen, the morally and socially unfortunate, without descending to sentimentality; his open eye for the powerful temptations to sin in every position, whether high or low, rich or poor (he expresses his love for the rich young man); his purpose to save his fellowmen in all classes, not in the sense of a divine redeemer, but in a genuinely and truly human spirit; these are traits in the character of Jesus which will always appeal to any one who has a deeper insight in human nature, and they are traits which I think will never be erased from his character.

Of course there will always be those, as I know from personal experience, who will scoff at the parable of the prodigal son, and there will always be "such Philistines as Ed. von Hartmann, by whom Jesus is looked upon dubiously on account of his company with publicans and sinners and fallen women. Jesus did not know the idea of what was proper and becoming" (Weinel). It is this trait of Jesus combining on the one hand his strong condemnation of sin, on the other the acknowledgment of the fearful power of temptation—followed when yielded to by the burden of guilt—and his sympathetic attempt to bring the erring and repentant sinner into the right relation with God, his fellow-man and himself again, that has contributed so greatly to transfer upon Jesus later the idea of a saviour as in the case of Buddha.

If with this high mission to save the sinner by arousing in him a conviction of guilt coupled with the announcement of a forgiving and merciful God toward the truly repen-

tant, Jesus combined a stern adherence to his purpose, not letting himself be turned aside even by his nearest relations, his own family—we must not condemn this attitude but rather praise him for it. If we do not condemn other men for placing the demands of a higher mission above those of family ties and friendships, we ought not condemn Jesus for the same thing. In the end the alienation from his family when Jesus started out on his work, turned into complete reconciliation, for we find the brothers of Jesus, and especially James, acting a leading part in the formation of the first Christian community. We see here the influence of an overpowering personality.

It was the *daimon* in the sense in which Socrates uses this word,—the *daimon* of that higher power impelling him in his work, which also led Jesus. If the influences directing the inner life and consciousness of Jesus had an oriental aspect, an ecstatic and visionary character, this must not repel us. To the modern man of course the ecstatic experiences of Jesus at the time of his baptism and at other times seem strange. These awakened in him the consciousness of being the instrument of a divine mission, and confirmed him so thoroughly in this persuasion that the charge of blasphemy could be brought against him at his trial before the sanhedrin. Still they gave Jesus strength and awakened that implicit faith in his mission among his followers which even his final tragedy could not obliterate.

I will say here incidentally that the baptism of John is surely historical, especially since it has been always a stumbling block to the dogma of the sinlessness of Jesus. John's preaching of the nearness of God's kingdom, the announcement of one coming to baptize with the Holy Spirit those willing to bear good fruit, and with fire those who were merely chaff, must have made a deep impression on Jesus. For he was certainly of a deeply religious and

introspective character no less than Paul, and this combined with the knowledge of such prophecies as Joel ii. 28, speaking of the outpouring of the Spirit in the last days, and of Mal. iv. 4, speaking of the coming of Elijah to prepare the way before the last period, must have brought him to the decision to consecrate his whole person to saving his people, after having been convinced like Paul (compare Gal. i, 15) that God had by his grace chosen him for that purpose.

Since we have often judged leniently in history of the consciousness and elation of many a genius in art, music, literature and other activities, when they considered themselves selected instruments of higher ideas, of a divine mission, though this conviction has often revealed itself in a strange and often repellent form, we ought also to use the same attitude towards Jesus, who surely must be classed with the religious geniuses who gave religion a further impetus to progress.

After all, the consciousness of Jesus that he served a divine mission did not manifest itself in such a very strange way, if we except the form expressed in the speculative Fourth Gospel, which is only a later reflection of the personality of Jesus. And perhaps even the Synoptics have confused certain reflections of the primitive Christian community with the original form in which Jesus expressed himself (compare Matt. xi. 25-30).

Moreover, Jesus did not make use of his ecstatic experiences and Messianic pretensions, if he had the latter, for his own interest and glory. He sought to serve, not to reign; to save not to destroy; he did not arouse his people to a bloody revolt against the Romans. His entry in Jerusalem on an ass was probably an actual fact, not only a legend based on Zech. ix. 9, as Strauss assumed, for we have a parallel in Mohammedan history of Salman, the governor of Medinah, "who at the time of the dis-

sensions of the califs, rode upon an ass in order to show his advocacy of peace according to the account of Ibn Kutaibahs" (*Jewish Encyclopedia*, art. "Jesus").

It seems certain that Jesus sought rather the spiritual and moral regeneration of his people, leaving their deliverance from the heavy yoke of the Romans until the coming of God's kingdom, soon to be expected. Nevertheless, the enthusiastic acclamations of his Galilean followers at his entry; the suspicious eye of the Roman administration; the criticism of the spiritual leaders of the people; the perhaps not wholly unpatriotic attitude of the hierarchy to keep the nation quiet, even if self-interested motives on their part may have run along with this; the disillusionment of many—perhaps even among his followers—because Jesus did not entertain political aspirations, all these accidents combined brought him to the cross. Had he headed an insurrection he would perhaps have shared the same fate, but his name would have probably gone down into profane history together with a Judas the Galilean, Theudas and others, whereas instead it went down at first only as that of a beloved and adored master and rabbi among a quiet Jewish sect of religious brotherhood. When this brotherhood gradually expanded, outgrowing its Jewish shell and coming into conflict with the Roman state religion, it then became known also in political history.

Even the stories of the resurrection of Jesus and his appearances after his death, started first by three Galilean women, had entirely a Jewish garb, if we consider the extravagant stories of the Talmud about beloved and adored rabbis, upon whom *Shechina* (the presence of God) was believed to rest, and whose bodies were thought not to be liable to corruption in accordance with the notions of other Semitic peoples who believe even to-day that their saints continue to live after death. The *Jewish Encyclopedia* is probably right in stating that the legendary lives

of Jewish saints like Onias and others in the Talmud must be compared before a true estimate of Jesus can be formed.

That Jesus was not only a healer and exorcist, but just as much a religious and moral teacher, there is no doubt. I do not see any necessity to assume that there were existing books containing the sayings of a saviour or master and probably derived from Indian or Buddhistic sources which were attributed to Jesus. This may be admitted to some extent as in the case of the late Fourth Gospel where vii. 38 is evidently of Buddhist origin, but we must guard against assuming a loan in every parallel thought. The religious and moral spirit of Hebrew thought was not so unoriginal as not to be able to furnish parallelisms to sayings of other great religions. The saying of Buddha cited by Mr. B. K. Roy (*Open Court,* Jan. 1914, p. 59) for instance:

> "One may conquer a thousand men in battle,
> But he who conquers himself is the greatest victor,"

is paralleled by Prov. xvi. 32: "He that is slow to anger is better than the mighty, and he that ruleth his spirit than he that taketh a city." There is no need to assume a connection between these sayings, although Proverbs in its present form very probably dates from the Alexandrian period. The above-mentioned Jewish *Aboth* refers to this saying of Proverbs with regard to the question, "Who is a true hero?" and Jesus says: "Blessed are the meek, for they shall inherit the earth."

The Jewish religion could very well bring forth independently a religious and moral teacher like Jesus. So many of his sayings of the highest spiritual and moral order can be paralleled by similar sayings in the Jewish fathers, that Jewish scholars point to them and say: "Did Jesus teach anything new?" Is there then any necessity to refer them to some foreign book of the sayings of a

saviour or ideal man? Jesus as a moral and religious teacher is entirely explainable on the basis of that spirit of the prophets of the Old Testament and of those Jewish teachers since the close of the canon who always dwelt more on the inner spirit of the law than on its letter or the traditions of the elders which were attached to the law and drove out all life from religion. Such men were Antigonus of Socho and Hillel of the pre-Christian century, of the first of whom the saying is recorded: "Be not slaves who serve a master for the sake of compensation, be like such servants as labor for their master without reward; and let the fear of heaven be upon you." Compare a similar saying of Jesus.

"Jesus spoke with the authority of the Haggada[2] as opposed to the legalism of the Halachists" (*Jewish Encyclopedia*). It is this fact, that Jesus was a moral and religious teacher representing the flower of the best spirit of Hebrew religion coupled "with his anti-Essenic and anti-Pharisaic attitude toward the fallen, opposing the barrier between the better classes of society and the *Amharez*"[3] (*Jewish Encyclopedia*), coupled further with the expectation of the approaching end and the coming of the kingdom of God, that gave Jesus his importance in the origin of Christianity.

In this connection we will compare the prayer of Jesus (Matt. xii. 25) with the prayer of a rabbi in the Talmud (*Berach.* 28. 2) when leaving the school of learning. Jesus prayed: "I thank thee, O Father, Lord of heaven and earth, because thou hast hidden these things from the wise and prudent and hast revealed them unto babes." The rabbi's words run thus: "I thank thee my God, that thou

[2] *Haggada* (from Hebr. *hagad*, to say,) is the free interpretation of scripture for homiletical purposes as opposed to the authoritative *Halacha*, the Jewish oral law supposed to be of divine origin like the written law. It made much use of tale, parable and allegory.

[3] *Amharez*, the rabbinical term for the *plebs*.

hast given me my portion among those who sit in the house of learning and not those who sit at the corners of the street. I rise in the morning and they rise in the morning; I rise to occupy myself with things concerning the law, they rise to occupy themselves with things which are useless. I work and they work. I work and receive a reward, they work and receive no reward. I run and they run. I run to everlasting life, they run to the pit of destruction."

Especially the "heavy laden" must have hailed the preaching of divine mercy as a great evangel—those who were oppressed outwardly by hard toil, or inwardly by the feeling of being far below the demanded ideal, "Be ye therefore perfect, even as your Father which is in heaven is perfect," for this feeling has always been the most depressing burden with deeper minds.

A similar effect is noticeable in the doctrine of "boundless mercy" of the Buddhist Hongwanji or Shinshu sects in Japan. This preaching of Jesus must have drawn many hearts to him and must have formed a brotherhood around his name even after his death. His death especially glorified him, and his followers must have early believed that the *Shechina* had dwelt upon him. They must have hailed him as a special divine messenger, "a man approved of God," as Peter calls him Acts ii. 21.

The divinization of Jesus had already begun when Paul, a man of deep introspection and filled with the consciousness of the insufficiency of all moral aspiration to reach the ideal, as expressed in Rom. vii. 14-24, heard of the crucified Nazarene. This honest Pharisee, a Hellenistic Jew, inclined to a broader conception and versed in the rabbinical terminology concerning the Messiah as "the heavenly, the last Adam," was overwhelmed by the faithfulness of the first followers of Jesus to their master, and so this Jesus rose higher and higher in his estimation, and finally became the metaphysical Christ who has come upon

earth to save all mankind. The personality of Jesus must at least have made such an impression upon Paul that he felt justified in seeing in him an incarnation of the heavenly Christ. "He must at least have become persuaded that Jesus was not an unworthy person. If Paul speaks of Jesus as one without sin, which of course is rather more a dogmatic proposition,[4] he could only apply this to him if he had the impression that Jesus died innocently and was not crucified rightly as a blasphemer and wicked person" (Weiss).

That Paul knew nothing of Jesus is a very strong assertion. Is it possible that a man who stayed fifteen days with Peter and James after his conversion, and also met them in other ways, who also knew other Jews that belonged to the first Christian community before he himself joined them, such as Barnabas, Andronicus and Junias (compare Rom. xvi. 7) should not have known anything of Jesus? That he rarely cites sayings of Jesus is no proof that he did not know of any. He probably presupposed a knowledge of them with his readers, and moreover the nature of his dogmatic and polemic writings did not offer much opportunity to refer to them. That he knew of sayings of Jesus and knew of him as a teacher, we have a proof, as Weiss rightly says, in 1 Cor. vii. 25, where concerning a certain question he says he has "no commandment of the Lord" (compare also verses 10 and 12).

After all, in order to be just to Jesus, even if we do not assume him to be the sinless God-man of orthodoxy or the ideal man of liberal theology, we must admit that he must at least have been of a very high religious and moral character, measured by the times in which he lived, or else Christianity could not have gathered around him as the nucleus of a new religion. The words of the noted

[4] In the Talmud friends console a rabbi over the death of his son, because he died sinless, having spent his time in sacred study.

philosopher and Sanskritist Deussen in his latest book *The Philosophy of the Bible*[5]: "Only a fool can doubt the historicity of Jesus," are certainly too strong, but he is surely right that "in Jesus the Jews killed one of their best men." Of course he grants that it was only a small minority who did this and under peculiar circumstances.

Modern Jewish scholars seem to me sometimes to be more impartial and just to Jesus than Gentiles. They also claim Jesus as one of the best men of their nation, and I think they can very well understand how the death of Jesus could have been looked upon as an atoning death, even among his earliest followers, on the basis of such a purely Jewish idea that the death of a righteous man is of great value.

Christianity might possibly have developed without Jesus with all its dogmas and the same ethics as it has now. Still it is peculiar that this did not take place on the basis of such mythical personalities as Mithras, Attis and Adonis, but on the basis of a historical person like Jesus; and for this reason I think his character and importance in the origin of Christianity must not be under-estimated.

A. KAMPMEIER.

IOWA CITY, IOWA.

[5] See an excerpt from Deussen's book on another page of this issue.

THE CRITICAL TRILEMMA.

THE great triangle of judgment concerning the Christ or, more strictly, the Jesus presents these mutually incompatible theses:

1. Jesus was Man and God,
2. Jesus was Man and not God,
3. Jesus was God and not Man.

The first is orthodox, the traditional view.[1] It calls for no discussion, it is not discussible; for it is the denial and renunciation of thought. No meaning can be attached to the compound God-Man. One may discourse about it forever, but can really form no idea and convey no idea that is intelligible or debatable. This thesis then belongs to the realm of faith, not of reason.

The second view is accepted with practical unanimity by the critical intelligence the world over. It makes no difference what kind of a man or how great a man one may take Jesus to have been, whether a miserable degenerate (with Binet-Sanglé), or a strange combination of contradictions (with Karl Weidel), or the synthesis of every conceivable excellence in the highest degree (with Vorwerk),—man is man and nothing more.

[1] Any one eager to enrich the language with sonorous vocables might find occasion in devising appropriate names for these three views. The first might be called dualistic or androtheistic; the second, liberal, historistic, or andromonistic; the third, radical, symbolistic, or theomonistic. The term allegorical does not seem so good as symbolistic, and the adjective *mythic(al)* would be both misplaced and misleading. *Theomonistic* may be somewhat pedantic and outlandish, but it strikes nearest the bull's eye, for the most distinctive mark of the protochristian movement was its *militant monotheism.*

This view has met with such general acceptance among the "liberals" solely as a reaction from the orthodox dogma of Chalcedon, which they recognized as meaningless and impossible, and in supposed default of any choice, and not at all because of its inherent rationality or plausibility. The liberal critics rashly assumed that there was only one logical alternative, that the Jesus was surely either God-Man or mere man; on rejecting the first they felt forced to accept the second. Hence for a century the problem has been, How shall we understand and explain the New Testament and primitive Christianity on the hypothesis that Jesus was mere man? Immeasurable learning, indefatigable industry, inexhaustible patience, the keenest insight, the most piercing acumen, the most vivid imagination, the subtlest analysis, the boldest synthesis—all have been enlisted unceasingly and in every Christian country and in lavish extravagance in the persistent attempt to rationalize and make comprehensible the great facts of the New Testament and Protochristianity on the hypothesis of the pure-humanity of Jesus.

This splendid and heroic enterprise, though employing all the enginery of the human mind in its completest equipment, has issued in failure total, absolute, undeniable, and irremediable. Not one single feature of Protochristianity has been explained. No light whatever has been thrown upon the miracles, none upon the doctrines, none upon the early life. Neither has any *progress* been made towards any solution. The darkness is just as deep as ever, the diversities and contradictions among the critics become ever sharper and more numerous; there is not one that can satisfy himself much less any other, nor is there anywhere offered any outlook for improvement. The deepest researches of such as Reitzenstein, Norden, Charles, Reinach, Loisy, and Frazer in no way come to the support of

the liberal positions but at the very least necessitate complete re-formation of the lines of defence.

In the foregoing the language may sound a trifle strong, but it is not a whit too strong. It does not exaggerate the facts in the case. The bankruptcy of liberal criticism is as utter as such bankruptcy can be. It is not then too much to say that the situation as viewed from the second standpoint is hopeless. It must be repeated that when highly cultured and intelligent men tell us glibly and confidently that Jesus was merely a remarkable man, they do so simply and solely on the principle of the Excluded Middle, reasoning thus: He was either God-Man or pure man; but God-Man is impossible; therefore he was pure man. Convinced by such logic, they make no serious attempt to comprehend the New Testament and Protochristianity on their hypothesis, but merely feel confident that some way or other these phenemona *must* be comprehensible. Whereas, if they would make earnest effort to grasp the situation, they would soon discover that they were in a blind alley, that it was just as impossible to understand the historical and literary facts in terms of the pure-human Jesus as to understand the Jesus as at once both human and divine.

Such being the state of case, we are driven to inquire whether there be not another possibility, and instantly we discern a long neglected alternative: *Jesus was God.*

The full meaning of this statement is not easy to realize, still less easy to express in a narrow compass. It is not meant that Jesus was the metaphysical or cosmical God of Plato or Aristotle, of Zeno or Epicurus, still less the God of dogma, of Athanasius or Augustine or Thomas, or of Rome or London to-day. Nor again a mythical or astral or nature God, such as flourished in the many-named faiths of the circum-Mediterranean region. What is meant

is that Jesus was a certain person or aspect of deity, the aspect that recommended itself particularly to the religious mind of the Jewish Dispersion. Jesus was the Jehovah of the Hellenistic consciousness, of the Jewish consciousness as it was modified and profoundly modified by constant contact with the more or less nearly allied Greek consciousness in matters of religion. We might almost say that Jesus was Jehovah Hellenized. Of course, any such compact formula must sacrifice verity to brevity. In fact, this Hellenization could not run quite the same course in any two minds. The individual reaction necessarily varied from man to man. So Jesus could not mean quite the same for any two. The shades of conception varied like the colors of the spectrum, insensibly from one extreme to another. Yet there were certain resemblances and distinctions broad and clear enough to mark off certain groups with more or less clearness. An aspect or person of God was truly God and yet did not exhaust the idea of God; it was very God, and yet not all God.[2] Nothing like logical or metaphysical accuracy or consistency is to be expected in the deep musings of these Protochristians; on the contrary, we must expect to find all manner of contradictions, often patent, more often latent; we must expect to find them lying quietly side by side in our scriptures. Nor must we hope to find the divine and the human sundered completely in these early notions, any more than the material and the spiritual in early Greek philosophy.

It is not strange then that from the fusion of Jewish theologic-religious and Greek mythologic-philosophic thought there should have issued a compound or rather

[2] We have a similar case in the Bolzano-Dedekind-Cantor doctrine of infinity, where a part equals the whole, that is, may be set in one-one relation with the whole. Thus, of the infinite assemblage of integers 1, 2, 3, 4, 5, 6,.... $2n$.... we may pick out the *even* integers, 2, 4, 6, 8,.... $2n$,.... which form only a *part* of the original assemblage. Yet on taking out the factor 2 from these even integers we obtain the original assemblage 1, 2, 3, 4,.... n ...., $2n$,..... The part is equivalent or one-one related to the whole.

compounds, many-colored[3] and many-shaped, a new deity or aspect of deity that itself presented varied aspects. Here the Greek, there the Jewish, tinge would be deepest, yonder they would vie in hue. For some the great concept of the Son of Man, present in Daniel, dominant in Enoch, would be most fascinating; they would frame their phrases in accord therewith. Others might be more attracted by the suffering Servant of Yahveh, and would delineate an experience along the lines laid down in Isaiah lii. liii. They might easily extend the analogy to include the Alexandrian Wisdom and devise a career in which countless Old Testament phrases would be mirrored, saying, "(All) this was done that the scripture might be fulfilled," as in Matt. xxi. 4, where it is plain that the incident is a pure invention, to fulfil the scripture prophecy. Some again might sail on still loftier wing: they might dream of a second Adam, of a Man from heaven, of a new order of spiritual being ushered in by the new deity. Still others might remember the Stoic or the Philonic Logos and might conceive of him as Son of God, as an emanation from the inmost bosom of God conceived as the Father, an idea far older than either Philo or the Porch. Yet others might seize upon the genuine Jewish notion of the Messiah, the Christ, and sublime it into the concept of the vicegerent of God, the envoy extraordinary, the ambassador plenipotentiary of the court of heaven unto all the nations of the earth. Indeed, there seems to be no limit to the divagations of religious and theosophic fancy when once set free to roam at will in such airy realms. To any one who properly estimates the mythopoetic faculty and its enormous importance in the history of civilization, none of the foregoing need seem remarkable, but in any case it was certainly all actual, for exactly those ideas and countless

[3] πολυποίκιλος, Eph. iii. 10.

others more or less similar are indubitably present in the New Testament and other early Christian literature.

But in all of this diapason there is one ground-tone that sounds out clearer than any other. It is the great note of *salvation.* Above all else the new deity is the *Saviour.* For this the pure Greek[4] is used in the New Testament only 24 times: 8 times it is "God (the) Saviour" or "Saviour God"; twice it is "Our God and Saviour Jesus Christ (or Christ Jesus)"; 4 times (in 2 Peter) it is "Our Lord and Saviour Jesus Christ"; twice it is "Saviour of the world" (John iv. 42; 1 John iv. 14); thrice (Titus i. 4; iii. 6; 2 Tim. i. 10) it is "our Saviour"; five times it is "Saviour." It belongs to the later strata of composition (Johannines, Pastorals, 2 Peter, Jude), elsewhere only in Luke i. 47; ii. 11; Acts v. 31; xiii. 23; Eph. v. 23; Phil. iii. 20. A favorite with the Gnostics, it lost caste with the orthodox, who substituted "Lord." But instead of this pure Greek, that smacked maybe too much of paganism, the New Testament puts Jesus and preferably The Jesus. This was *understood* to mean *Saviour,* as is clear from Matt. i. 21, "And thou shalt call his name Jesus, for it is he that *shall save*[5] his people from their sins." Justin Martyr and Epiphanius both interpret the name as Saviour; that their etymology was not quite correct makes no difference, the question is not what the name really meant (Yah-help) a thousand years B. C., but what it was *thought* to mean in the first century A. D. (or B. C.), and that was Saviour.

The salvation was from sin or sins. The chief sin, which dragged all others in its train, was idolatry. The chief mission of the "Saviour of the world" was to save it from idolatry, from false worship of false gods. Such was almost necessarily the central idea of a new mono-

[4] σωτήρ. [5] σώσει.

theism in the midst of polytheism. This great controlling idea is expressed beautifully under a host of symbols in the Gospels. The world to be saved, mainly Gentiles, but partly Jewish or half-Jewish, is represented as a human being suffering from some form of disease or affliction, as sick or halt or blind or leprous or even dead, and to this wretch the Saviour-God, the Jesus, brings healing. A still more favorite image depicts the polytheistic world as a man possessed of demons (the gods of heathendom), or more pathetically as a fallen woman (an unchaste woman being the regular Old Testament term for an idolatrous people); the Saviour-God, the Jesus, expels the demons, forgives the sins of the woman, who worships him (i. e., who is converted to monotheism, to the Jesus-cult).

Beyond this framework of ideas the earliest Gospel (in all probability) did not extend. The scene is lead in Galilee of the Gentiles, to represent the rising on benighted heathendom of the great light, of the proclamation of salvation, of the Saviour-God, the Jesus, that is, the preaching of "the monotheistic Jesus-cult" (Deissmann), of the worship of the One God under the aspect of Saviour (from sin, i. e., from idolatry). But at an early date there was made a most important addition: Some imported from their own abandoned heathen cult the notion of a "dying God," of a god that saved his people by dying for them, a notion derived originally from nature-worship or from the sacrifice of the king to preserve the vigor of kingship, but held very tenaciously by many even after conversion from polytheism, even as our Germanic ancestors still clung to their heathen notions long after conversion to Christianity. What more natural than to engraft this pagan notion on the primitive Gospel, which was especially easy to do, since the suffering Servant of Yahveh is represented (Is. liii.

12), as "pouring out his soul (Septuagint, 'was delivered') unto death."

The especial form that this representation should take may have been given by an expression in Heb. vi. 6,[6] where it reads like a quotation, "crucifying to themselves the Son of God and putting him to an open shame." The phrase is used of such as at first accept the doctrine of the Christ[7] but fail to go on with it, falling by the wayside and bringing the doctrine into contempt and disrepute: the word *crucifying*[8] seems nearly equivalent to *pillorying*. That the word is used figuratively seems indicated by the phrase "putting to open shame."[9] The only conceivable way in which this could be done was by rejecting the doctrine of the Son of God, and since actual crucifixion is out of the question, and since the two participles seem quite parallel, we must asume that their meanings are nearly the same. Even though there be no adducible case of *crucify*[10] used in the sense of *pillory,* yet we know that the cross was the punishment of slaves and miscreants, that it was considered peculiarly ignominious, so that it could hardly escape becoming a symbol of shame and disgrace (Heb. xii. 2). Such a sense seems demanded by the context in this passage. If now such be the case, then we may easily see how from this germ may have sprung up the whole story of the crucifixion. The Jews of Jerusalem, who rejected the doctrine of the Jesus and may even have tried to repress it, are most vividly and dramatically represented as arresting, trying, condemning the Son of God, the Jesus, and then calling on the Roman government to carry

[6] Hereby it is not at all excluded, what is emphasized in *Ecce Deus,* that the famous impalement of the righteous one (in Plato's Republic, II, 361D) may have suggested the idea of the crucifixion of Jesus; but the part of the Jews and of Jerusalem must have been derived from elsewhere.

[7] *τὸν...τοῦ Χριστοῦ λόγον,* Heb. vi. 1.

[8] *ἀνασταυροῦντας.*

[9] *παραδειγματίζοντας,* making *him* a public example.

[10] *ἀνασταυροῦν.*

out their verdict, which they themselves could not legally do.

Now it is well known that the whole account swarms with improbabilities. Such a hasty proceeding at such a time appears credible only when all things are possible. This matter has been set forth so repeatedly and conclusively that it would seem needless to dwell on it here. There is in the whole story not a single feature of likelihood. Even Brandt, who does not question the traditional view, in his learned *Evangelische Geschichte* is compelled to reject the major portion as palpable fiction, and the remaining fraction he retains for the most insufficient of reasons, because not in itself unbelievable nor showing any obvious tendency. If indeed the central fact of the crucifixion were itself independently well assured (as Brandt would naturally assume in 1893, but by no means now), then such reasons might be admitted, in the absence of counter-reasons. But since now the focal figure of Jesus can not be proved to be historical (as conceded by representative historicists themselves), the hypothesis of the historicity becomes needless, being no longer necessary. We must in accord with Occam's law of parsimony explain as many as possible of the details of the Last Days in some such way as Brandt (among others) has so successfully employed on the majority; nor does it appear that there is any single feature that *may* not thus be explained.

All the more confidently do we go at this work, since it is now coming into clearer and clearer evidence and is admitted by such authorities as Harnack that the "Sayings," the Q-source, the oldest form yet known of the Gospel, did *not* contain any such account as we now read of the Judean ministry or the presence of Jesus in Jerusalem, but was confined to Galilee. It calls for the utmost zeal and for almost superhuman ingenuity to reconcile such a fact with the historical authenticity of the Passion

week and its central feature, the crucifixion. On the other hand, we have now a thoroughly satisfactory explanation in terms of motives, methods, and materials, all of which are known independently to be not only real but also favorites with the men of that time and place.

It is a very strong confirmation of this interpretation of the Passion-week, particularly the crucifixion, as a symbolic-dramatic homily on the Jewish rejection of the Jesus cult, that it is the motifs of shame, of ignominy, of mockery, and of Jewish unbelief and contempt that are plainly conspicuous, and by no means any motifs drawn from Jesus himself, whether his power, his love, or his suffering. These latter contribute little or nought to the representation, whereas even the old festival of the Sacæa at Babylon is made to contribute to the picture of the shame and ignominy to which the king is subjected. It has been argued that the details of the soldiers' mockery (about which the disciples could have known nothing, but which are narrated in the same spirit as all the rest) must be historical, because so closely resembling the Sacæan! Whereas it is obvious that the latter merely furnish the model for the fictive imagination of the Evangelist. Similar relations abound in history.

To the foregoing it remains only to add that the supremely important incident of the resurrection is now admitted in all critical quarters to be unhistorical. The liberal rejects decisively the notion that his mere man Jesus rose up from the dead or was in any way resuscitated. The liberal concerns himself not for an instant with the question, How did Christ rise from the dead? (which he denies *in toto*), and vexes himself solely with the purely psychological question, How did the disciples *come to believe* that Jesus rose from the dead? This question alone has for liberals any rationality. They seek solely to explain the amazing mistake of the disciples, from Magde-

lena and Peter down to Saul of Tarsus. In this quest of an explanation for such an era-making delusion they have squandered the most splendid abilities, all absolutely to no purpose whatever, except to make more and more indisputably evident that all such efforts are idle and that no such explanation is possible. At this point the victory of the orthodox over the liberal critic is complete and certain. It is folly in any one to reject the physical miracle of resurrection as incredible and then to accept the psychical miracle of the universal belief in that resurrection as convincingly attested; for the belief is just as incomprehensible as the thing believed. To convince oneself of the hopelessness of the task of making the belief in the resurrection intelligible, it suffices to read carefully the theories of the greatest masters, the biographers of Jesus, such as Keim and Volkmar, Holtzmann and Pfleiderer, Renan and Reville, and even Loisy and Holsten. The keener the critic's intellect, the absurder his theory.

On the other hand, the radical criticism offers a solution in perfect harmony with all the ascertained facts in the case and of a piece with the general body of symbolic interpretation that is demanded for understanding the Gospel, as well as in accord with modes of speech current in evangelic circles. This solution is set forth in *Der vorchristliche Jesus,* in the essay entitled "Anastasis." Though not yet accessible in English, it cannot be reproduced here even in substance, it must suffice to indicate the barest outline: The doctrine of the resurrection was not at first stated in the word *Anastasis,* but almost certainly (as in Acts) in some such form as "God hath raised up Jesus." It is unlikely that the primitive preacher meant "resuscitated" or "revived" by the term "raised up." Other words were at hand, which he would have used more naturally. On the contrary, the term "raised up" in both of its Greek

forms[11] as well as in its Hebrew equivalent (*qûm*)[12] was regularly used to denote—not resuscitation, far from it, but — establishment, appointment, installation; in fact, *anastasis* is literally *up-setting* and it is commonly used exactly in this sense of overthrow,[13] but also in the exactly opposite sense of *setting-up,* establishing (as in Luke ii. 34), erecting (as of walls, trophies, images, etc.). It is only in this latter sense that the verb is used in the New Testament, and though the raising-up *might* be "from the dead," yet this latter phrase is not needed and is sometimes positively excluded. If we would discover what the first preachers would have meant and what the first hearers would have understood by the words "God hath raised up Jesus," we can not do better than to turn to the Old Testament and particularly to the Septuagint translation. Here we find that 'UR[14] is used four times of "raising up" a man, as "the righteous" (Is. xli. 2), "him from the north" (Is. xli. 25), "him in righteousness" (Is. xlv. 13), rendered by *egeirō* thrice, by *exegeirō* once; that *qûm* is used most frequently in the same sense and is rendered by *anistēmi*, more seldom *egeirō,* thus: "God will raise up a prophet" (Deut. xviii. 15, 18); "Yahveh raised up judges" (Judg. ii. 16, 18); "Yahveh raised up a Saviour" (Judg. iii. 9, 15); "Yahveh will raise up a king" (1 Kings xiv. 14, Jer. xxx. 9); "I will raise David a righteous branch" (Messiah) (Jer. xxiii. 5); "I will raise up for them a plant" (Ez. xxxiv. 29); "I will raise up a shepherd" (Zech. xi. 16), and especially "The man raised up for Messiah of God of Jacob" (2 Sam. xxiii. 1, Sept. "whom the Lord raised up for Christ of God of Jacob"). Here be it noted the very words of the Christian dogma are used. In Acts

[11] *ἀνέστησεν* and *ἤγειρεν.*

[12] קוֹם

[13] So in Herod. I, 177, 178 *ἀνάστατα* and *ἀναστάτου* mean "subjected," "overthrown."

[14] עוּר

ii. 24 Peter says "whom God raised up,"[15] a clear echo of the Septuagint, "whom the Lord raised up."[16] Now let us ask the "unbiased man," to whom the historicists are so fond of appealing, when Peter first quoted the words used of the establishment of "David Son of Jesse," is it likely that he used them with the same or with a wholly different meaning? And even if the latter, is it likely that his *hearers understood* them in the familiar or in a wholly unfamiliar sense? Consider also that in Acts ii. 30 we *must* refer this *raising-up* to the establishment on the throne of David. For it is declared, "therefore (David) being a prophet and knowing that with an oath God had sworn to him from the fruit of his loins to seat (one) on his throne, foreseeing spake of the *anastasis* of the Christ." If by *anastasis* here be meant the establishment of the Christ (on the throne of David), then all is in order, Peter is speaking rationally and is intelligible to his auditors; but if resurrection be meant, then the logic fails and becomes hard or impossible for the hearer to understand. What sense in saying that David, knowing God had promised to establish a lineal successor on his throne, foreseeing (the fulfilment) spake of the resurrection of the Christ? The following clause tries to explain this by misquoting Ps. xvi. 10. The Psalm says naught about flesh or corruption, even the Septuagint says not "flesh" but "thy holy one," as does the Hebrew. Such a misquotation seems plainly an after-thought of the Christian compiler, and no part of the earliest propaganda. Peter would have been called to order had he begun his preaching by such gross miscitation. In Acts xiii. 35 a similar misconstruction is attributed to Paul, but since the redaction of Acts falls near the close of the first century, there is no reason to hold Paul responsible; it is far more likely that it is the work of a reviser or compiler, nor is there any ground to

[15] ὃν ὁ θεὸς ἀνέστησεν. [16] ὃν ἀνέστησε κύριος.

affirm with Kautzsch that this "Scripture proof" (at least in this form) "formed part of the oldest Gospel preaching" (*Die heilige Schrift des Alten Testaments,* II, 123).

The next verse (Acts ii. 32) states merely, "This Jesus hath God raised up," and verse 36, "Surely then let all the house of Israel know that God hath made him both Lord and Christ." The following words, "this Jesus, whom ye crucified," are unnecessary and sound very like an interpolation. That the interpolator has been busy here is known and admitted. Even Von Soden brackets the six words *to kata sarka anastēsein ton Christon* (verse 30). The splendid verse 33, "By the right hand therefore of God raised up on high etc.," can not refer to any resuscitation, but must refer to the installation of Jesus as pro-Jehovah. Turning now to the similar discourse in Acts iii, we find our contentions greatly strengthened. In verse 22 the prediction of Moses is quoted, that "a prophet shall our Lord God raise up[17] for you," and in verse 26 the *fulfilment* is found in the fact that "unto you first God, having raised up his Servant,[18] has sent him to bless you etc." Common sense would demand that *raise up* means as nearly as possible the same in both verses; and it seems very hard to endure such a rendering as "God having resuscitated his Servant has sent him"; whereas the notion of the establishment of Jesus satisfies all requirements—the sending of Jesus is then obviously the proclamation of his cult.

It is true that verses 13[b]-15 refer plainly to the crucifixion, but these verses may fairly be taken to represent a later revision of the oration, indeed they *must* be so taken, if the whole situation is to be made intelligible: that Peter should have preached and convinced thousands that a man lame from birth had been made whole by the name of Jesus who had been crucified six weeks before as a malefactor, is incredible. Jesus appears before us as a God,

[17] ἀναστήσει. [18] ἀναστήσας τὸν παῖδα.

the viceroy of God most High, and the story of the Passion is just as much a later addition here as it is (by admission of such a staunch historicist as Harnack) in the Gospels.

On passing to Stephen's speech we find new confirmation. In Acts vii. 37 the same prediction of the *raising up* is cited, where there is certainly no hint of resuscitation. Coming now to the great speech ascribed to St. Paul at Pisidian Antioch (Acts xiii. 17-41) we find in verse 22 that God "raised up[19] David as King," in verse 23 we read that God "raised up[19] for Israel a Saviour Jesus, John having forepreached before face of his entrance etc." Here there is surely no reference to resuscitation but only to the introduction of the Jesus.[20] It is true that many very old MSS. read "led"[21] instead of "raised up,"[22] and this reading is preferred by the editors; but it is enough for our purposes that many old and high authorities read "raised up" as given above. In verses 32, 33 it is again stated that God had fulfilled the promise to the fathers by "raising up[23] Jesus," where the sense of establishment is necessary, and of resuscitation impossible; for it is the Ps. ii. 7 that is quoted as fulfilled, "Thou art my Son, I this day have begotten thee," where the reference is certainly to installation. True there follows straightway (verse 34) an attempted proof that "he raised him from the dead," but this seems to be an after-thought, and may surely be understood easily as the work of the reviser.

This reviser here uses *anestēsen* because he is trying to explain the *anastēsas* of verse 33; everywhere else he uses the term which means "rouse up" rather than "raise

[19] ἤγειρεν.

[20] Verses 27-31 refer to the Passion, but are clearly marked as a later insertion: verse 26 connects naturally not with verse 27 but with verse 32, with which verse 31 does not connect naturally. Leave out these verses, and see how much more smoothly it reads. That the interpolator has been busy here is *certain*, for in verse 29 some excellent ancient manuscripts contain an important addition of ten words.

[21] ἤγαγεν. [22] ἤγειρεν. [23] ἀναστήσας.

up,"[24] as in Acts iii. 15; v. 30; x. 40; xiii. 30, 37; xxvi. 8. This use was very natural, for though "rouse up" may be used of inauguration and is so used in the Septuagint (as we have seen) and also in Acts xiii. 22, 23, yet its idea lies closer to "resuscitation" than does that of "raise up." In the Epistles it is everywhere *egeirō*, never *anistēmi*, though the middle form, "rise up"[25] is used oftentimes in allusion to the dead (Eph. v. 14; 1 Thess. iv, 14, 16).

In Ephesians it is the spiritually dead, in Thessalonians the writer seems to refer (verse 14) to a dogma rather than to an historical fact. In Heb. vii. 11, 15 the reference is certainly not to resuscitation but to the rising-up or appointment of the great "High Priest after the order of Melchizedec," i. e., to the inauguration of the new deity or his cult.

It seems clear then that the phrase "raised up Jesus" originally referred to the historic installation of the new God, Jesus, or what is nearly the same, to the introduction of his cult, and the word *anistēmi* was preferred, in its regular Septuagint sense. Gradually, as the doctrine of the "dying God" pleased more and more the Gentile converts, as the Passion week intruded into the primitive Gospel, the application of the phrase was diverted to the resuscitation of the Crucified, and the verb "raise up"[26] was either explained to mean resuscitate or was displaced by "rouse up,"[27] which more naturally suggested revival. A strong witness to this process is found in Matt. xxvii. 53 (admittedly a very late passage), where the term *egersis* is used, instead of the regular word *anastasis*, to denote resurrection. In *Der vorchristliche Jesus* (pp. 228-232) it is shown that the phrase "from the dead"[28] seems to have come in gradually, in many places by interpolation.

Such appears to have been the original sense of the phrase "raised up Jesus," and such its gradual, though

[24] ἐγείρω. [25] ἀνίσταμαι. [26] ἀνίστημι. [27] ἐγείρω. [28] ἐκ νεκρῶν.

very early, transformation of meaning. Somewhat similar changes abound in the histories of cults and religions, where they shine clear to the eye of the modern student, though less evidenced than the one in hand. Surely no one can maintain that such a process is impossible, certainly no one has tried to show any improbability in the foregoing conception. Pfleiderer did indeed pronounce it "perverse" (*verkehrt*), but without the display of reasons. Critics have in general avoided it, though some have admitted in print that the essay on *Anastasis* was particularly hard to refute, and an illustrious Biblicist has (in a private letter) declared it the strongest of all contentions in *Der vorchristliche Jesus,* and on its face impregnable. In the presence of the admitted failure of all other attempts to understand the faith and dogma of the resurrection, this one would seem to call for consideration. The single obvious objection would appear to be that it presupposes extensive revision and modification of the primitive forms of the New Testament writings, or at least of the original doctrines and documents that have been worked up in our present canonical scriptures; but he who is unwilling to proceed on this hypothesis may as well abandon once for all the problem of New Testament interpretation; for outside of it there is no hope whatever of understanding even the most obvious facts.

It may now be in place to give in conclusion a general though partial conspectus of the critical situation. The necessity of some other theory of Christian origins than the prevailing historistic theory, is shown in the following:

1. This latter theory is not now and never was plausible in itself; it is not guaranteed by any precedent or succedent in history; the supposed situation is extremely unlike any other presented in human experience, and the course of events is without any parallel in the annals of men; it is in fact quite unique, an incomparable exception.

2. The attempt to interpret Jesus as a mere man is only a first and natural reaction from the impossible conception of the God-Man and has little else to recommend it than that its only recognized alternative is unthinkable. As soon as the third possibility, Jesus was God (under a particular aspect or person), is distinctly recognized, the liberal view is at once stripped of all its fictitious necessity and even probability.

3. The complete failure of all attempts to discover an historical Jesus is clearly and convincingly set forth (in Schweitzer's "Quest of the Historical Jesus") by a very high authority in the very center of the liberal camp. One may agree or disagree with Schweitzer at a multitude of points, but it is impossible to shut one's eyes to the broad general fact that no progress has been made towards clearing up primitive Christianity regarded as an emanation from a personal focus, Jesus. Indeed, the most venerated oracles of criticism are coming to recognize this quest as hopeless. Loisy, while still cherishing the simulacrum of an historical Jesus, admits definitely that "it is not to the Gospel of Jesus, it is to the Christian mystery that the Greco-Roman world was converted." Similarly Söderblom in his new edition of Tiele's *Kompendium der Religionsgeschichte*. Not strange then that Kennedy complains that it is now held that "the mystery of Paul's conversion is his conversion to the mysteries." Unmistakably the humanity of Jesus is fast losing all significance for primitive Christianity, even in the hands of its stanchest defenders; it is becoming, in Ransom's fine phrase (in his review of *Ecce Deus*) "an utterly ineffectual source of Christian influence." While such critics fight furiously for the husk, they let the kernel disappear forever.

4. The historistic view fails wholly to yield us any intelligible or even admirable, much less lovable or adorable, character of Jesus. This fact is brought most clearly to

light in such a penetrating and sympathetic study as Weidel's on the *Persönlichkeit Jesu*. Weidel finds himself compelled to throw overboard all current conceptions of Jesus's character, yea, to reverse them at nearly every point. He is *forced* to think of Jesus as essentially choleric, wrathful, harsh, and even unjust in judgment; almost every trace of warmer and tenderer humanity vanishes, and there remains a character not unlike Fichte's in its moral fanaticism, only greatly exaggerated and narrow, and, what is even more significant, shot through and through every way with violent contradictions. These indeed Weidel not only exhibits but tries to reconcile, though with pitiful success. His painstaking and conscientious study leaves us with an incomprehensible medley of contraries instead of a character, and the appeal to Goethe as a parallel is merely bewildering. Weidel himself confesses the extreme difficulty of the situation, but thinks it *must* be overcome unless the peculiarities of the Gospel can be explained as mainly literary phenomena. Herein he is greatly right. The impressiveness of the Gospel portrait is essentially a matter of vivid rhetoric, and finds its explanation in the collective and contagious enthusiasm of a circle formed of many smaller circles of militant monotheists. This rare literary flavor may well be derived in a large measure from one or more specially gifted members whose names we know as little as we know the names of the authors of the 23d, the 90th, the 139th Psalm, or of a hundred others who have studded the firmament of religious literature with unquenchable constellations. The radical view does not deny nor depreciate the large contributions of personality and personalities to the protochristian movement, on the contrary it recognizes them in the amplest measure; but no one of these personalities was the God Jesus of primitive Christianity: they were all servants of the Heavenly Master.

5. The historistic view fails utterly to present any comprehensible picture of the activity of the Jesus, of his agency as it existed in the minds of the earliest New Testament writers. This fact comes clearly to light in such "a sufficient answer to its recent critics" as Bacon's *Christianity Old and New.* This master of exegesis recognizes three different types of "characterization of Jesus" as found in the New Testament: Paul's, Mark's, Q's. Each of these he perceives is "conventionalized": Paul's after the concept of the "Servant of God" (in the later Isaiah); Mark's "wholly different conception" "contains scarcely a trace of the Isaian conception," never predicates humility, forbearance, long-suffering, exhibits "heroism, virility, and power," "a superhuman authority," "already at the right hand of God," "more of defiance than humility"; the Q-conception (that of the "Sayings") presents Jesus as "the Servant of God who is the incarnation of his redeeming spirit of wisdom," following the "conventional ideal" of "the Alexandrian Wisdom literature." In particular, Bacon recognizes the famous "Come unto me etc." (Matt. xi. 25-30) as a "Hymn of Wisdom," referring to Norden's "Agnostos Theos" (1913). It was distinctly declared to be such in *Ecce Deus,* pp. 165-166.

It goes without saying that three such "wholly different" conceptions, conventionalized, discrepant, and without any support in any well attested words or deeds, can afford no firm historic basis for any understanding of the Jesus. Bacon in fact admits that "little indeed should we know of Jesus as he was, but for the Gospel of Mark," and yet Mark presents him (as already set forth in *Ecce Deus*) without any attractive qualities, in truth without human characteristics,—to quote Bacon— as "the Christ the Son of God," as an "authority," "in heroic proportions," whose "mighty works" are in "the foreground," "whose 'words of grace'....have almost disappeared."

Bacon confesses (p. 158), "the contrast between this conception and that of Paul could hardly be stronger within the limits of fidelity to historic fact." The closing phrase is evidently thrown in merely *pro domo*. According to Bacon's own statement it is superfluously manifest that these three conceptions (and he might have added a fourth, the Johannine) have no perceptible relation to historic fact, they are pure products of idealizing fancy, determined in form and contents by the temperaments of the writers and the *milieu* in which they were engendered.

As Wrede has most clearly shown, especially in treating Mark, and as Bacon knows excellently well, there is displayed nowhere in the Gospels any sense of "the limits of historic fact." It is plain in nearly every paragraph that the writers are trying to express ideas, and that they are using the incidents merely as a means of such expression, and hence the incidents are entirely plastic in their hands. This is generally admitted in critical circles concerning three-fourths, or even nine-tenths, or still more, of the total; of the small residue, where the *tendence,* the formative action of dogmatic interest, is not so clearly discernible, it is only our ignorance (of the original circumstances of the case) that is responsible. In no case has any alleged biographic datum been shown even probably to be really such; the "Pillars of Schmiedel" sleep in the dust. It is queer reasoning that, when the great bulk (which we do understand) is admittedly tendential and unhistorical, therefore the small remainder (which we do not *yet* understand) is naive and biographical! Such thinking goes directly against the chief methodological maxim, the Law of Parsimony, the Razor of Occam.

6. The historistic view fails to explain the transference of the propaganda from Galilee to Judea and the disappearance of Galilee from the subsequent history of the movement. This consideration has been set forth in *Ecce*

Deus (pp. 170-175) and appears to be decisive. No reply seems to have been attempted.

7. The historistic view fails to account for the world-mission of the new religion. Harnack admits that it did not start from any historic Jesus, whose precept and practice (he thinks) were all against it. But this world-mission was the very heart of Protochristianity; to concede that it did not issue from any historic Jesus is to concede that he was not the source of primitive Christianity.

8. The historistic theory can not explain the sudden wide-spread outburst of the propaganda, its apparently multifocal origin. This consideration has been enforced in *Der vorchristliche Jesus* (pp. 23-31), and though it has deeply impressed German reviewers, no attempt has been made to answer it—the trivial cavil of Weinel was most easily annulled.

9. The historistic theory fails to explain the relation of Paul to (any historic) Jesus, nor can it make Paul himself or the Pauline preaching intelligible. The latest and most ingenious essays on "Paul and Jesus" satisfy only their authors, while more and more the explanation of Paulinism is sought in the mystery-religions with which it has so many apparent points of contact.

10. The historistic construction wrecks utterly on the fact that it postulates an amazing personality in Jesus, a personality of astounding energy, ardor, enthusiasm, magnetism, and of the most restless activity, a personality that dominated all within its circle during life and still more after death—yet left not the slightest ripple in the course of events, is never mentioned in contemporaneous history, nor in any accounts independent of the early Christian! What is still more confounding, this impressive human personality disappears entirely and instantly from the earliest Christian preaching, which knows nothing of Jesus save as an over-earthly being, as a God. The references

to Jesus are of course frequent enough, but they are dogmatic and do not tell us certainly one single thing about his humanity, not one word that he uttered, not one deed that he did. This argument has been urged in *Ecce Deus* (pp. 18-25), it has deeply impressed such critics as Meyboom (*Theol. Tijdsch.*, 1912, p. 44), and it calls urgently for answer,—but none has been attempted.

11. The historistic hypothesis fails to explain the New Testament, more especially the symbolic element in the Gospels. That there is such an element, that it is extensive and important, and that it urgently demands honest, serious, and thorough-going consideration—all this is entirely beyond question. So much is indeed admitted by German authorities, such as Dibelius and Brückner. The obvious symbolisms discussed in *Ecce Deus* may be much increased in number. Sooner or later, criticism must make its peace with these momentous facts, and that will be the end of historicism.

12. The historistic theory can not explain extra-canonical old Christian literature; in particular, it can not explain the apologist, nor the *Teaching*, nor the *Shepherd* (of Hermas), especially the ominous silence of these latter as to any historical Jesus, their apparent utter ignorance of the whole New Testament story. The apologists have been treated (of course, not exhaustively) in *Ecce Deus*; the *Teaching* and the *Shepherd* are the subjects of elaborate essays ready for print. The argument from old Christian literature is conclusive; no attempt has been made to answer.

From the foregoing summary many most important considerations have been omitted, as too subtle or linguistic, or defying condensed statement. It remains to add that the symbolistic or radical theory is strong wherever its opponent is weak, that it has explained thus far every well-ascertained fact in the whole case, that in the happy

simile of the review of *Ecce Deus* in the *Christian Commonwealth* of London, "it fits in the New Testament as a key fits in the wards of its lock." It will doubtless receive enlargement and modification at the hands of such as Norden, Reitzenstein, Wendland, Hertlein, and other philologists, but its elements of truth are too obvious even for prejudice permanently to ignore. At no point thus far has it been successfully assailed (see "Leben Jesu, Kritik," *Theol. Jahresb.*, 1912-1913, pp. 239-252).

Meantime such scholars as Conybeare and his fellows may amuse themselves with "merciless criticisms" of the astro-mythologic interpretations of Robertson, Fuhrmann, Niemojewski, Jensen, Morosow, and with other irrelevancies. If some of these interpretations should maintain themselves, it would be highly interesting and even instructive; if one and all they should collapse like bubbles, no harm would be done, the radical symbolistic theory would not be in the least affected; for it depends upon such astro-mythology only as the tree depends upon the vine, or the wall upon the ivy.

WILLIAM BENJAMIN SMITH.
TULANE UNIVERSITY, NEW ORLEANS.

ON THE NATURE OF ACQUAINTANCE.

III.

ANALYSIS OF EXPERIENCE.

IN our first part, we took a preliminary survey of the objects experienced. In the second part, we considered the theory that experience is merely a certain interrelation of these objects, involving no particular existent in addition to what is experienced. Having found this theory unsatisfactory, we have now to seek out the additional constituent of experience, and to consider the nature of its relation to the objects experienced.

Before embarking upon our analysis, let us again take stock of those relevant facts which are least open to doubt. From the diversity of philosophical theories on the subject, it is evident that the true analysis, whatever it may be, cannot itself be among the facts that are evident at once, but must be reached, like a scientific hypothesis, as the theoretic residue left by the comparison of data. Here, as in philosophy generally, it is not the few logically simplest facts that form our data, but a large mass of complex every-day facts, of which the analysis offers fresh difficulties and doubts at every step. For this reason, if we wish to start with what is undeniable, we have to use words, at first, which, though familiar, stand in need of a dissection and definition only possible at a later stage.

The most obvious fact, in our present inquiry, is that, whatever may be the definition of "experience," some ob-

jects undoubtedly fall within my present experience, and of these objects some at least did not fall within my experience at earlier times which I can still remember. What is only slightly less obvious is that remembered objects sometimes —at least in the case of the immediate past—are still experienced, so that the objects experienced are not necessarily contemporaneous with the experiencing. It is obvious also that we can think of abstract facts, such as those of logic and mathematics; but in this case some argument is needed to discover what we experience when we think of them. If it were not for the fact that neutral monism has been believed, I should have said it was obvious that we can experience our own experiencing, and that this is different from experiencing the object of our experiencing; and in spite of neutral monism, I think a place must be found for what appears as an experience of our experiencing, since it is hard to see how otherwise we should have arrived at the notion that we have experiences.

At an earlier stage, we decided that our present experience can be known not to be all-embracing. It is sometimes maintained that this cannot be known, on the ground that if a thing lies outside our experience we cannot know that there is such a thing. At the risk of repetition, it may be worth while to repeat the reasons (belonging to logic rather than to theory of knowledge) which show that this argument is fallacious. An object may be *described* by means of terms which lie within our experience, and the proposition that there is an object answering to this description is then one composed wholly of experienced constituents. It is therefore possible to know the truth of this proposition without passing outside experience. If it appears on examination that no *experienced* object answers to this description, the conclusion follows that there are objects not experienced. For example, we may know Jones and paternity and the fact that every man has a father.

Then we know there is "the father of Jones," although we may never have experienced him. To consider this case more fully would demand a discussion of knowledge by description. For the present, it is only necessary to remove a possible objection to the view, which I shall henceforth assume, that what is experienced at any moment is known not to be the sum total of the things in the world. At the same time, it is important to remember that I can never give an actual instance of a thing not now within my experience, for everything that I can mention otherwise than by a description must lie within my present experience. This is involved in the very nature of experience, and is one of the most important of the obvious facts about it.

Experiencing is only one, though perhaps the most characteristic and comprehensive, of the things that happen in the mental world. Judging, feeling, desiring, willing, though they presuppose experiencing, are themselves different from it; they may be themselves experienced, and they doubtless require that we should experience the objects with which they are concerned, but they do not themselves consist *merely* in experiencing objects.

It is important to be clear as to the extent to which the experience of one mind may overlap that of another. Neutral monists have done a service to philosophy in pointing out that the same object may be experienced by two minds. This certainly applies, as a matter of fact, to all experiencing of universals and abstracts; it applies also, though I think only as a theoretic possibility, to the things of sense. But there remain a large number of things which only one mind can experience. First and foremost, an experiencing, as opposed to the mere object experienced, seems, empirically, not as a matter of *a priori* necessity, to be only capable of being experienced by one person. I can know by immediate experience what I am seeing at this moment; but

another person, though it is theoretically possible for him to see the same object, cannot, as a matter of empirical fact, know by immediate experience that I am seeing it. Exactly the same is true of other mental facts, such as judging, feeling, desiring, willing. All these can only be experienced by one person.

Thus when an object O is experienced by two different persons A and B, the experiencing of O by A is one fact, and the experiencing of O by B is another. The experiencing of O by A may be experienced by A, and the experiencing of O by B may be experienced by B, but neither can experience the other's experiencing. A can experience his experiencing of O without logically requiring any other experience; hence the fact that he experiences O cannot consist in a relation to other objects of experience, as neutral monism supposes. From these characteristics of experience, it seems an unavoidable inference that A's experiencing of O is different from O, and is in fact a complex, of which A himself, or some simpler entity bound up with A, is a constituent as well as O. Hence experiencing must be a relation, in which one term is the object experienced, while the other term is that which experiences. We might continue to call this relation "experience," but we have employed the word "experience" hitherto because it is a non-committal word, which seemed not to prejudge the issue of our analysis. Now, since we have decided that experience is constituted by a relation, it will be better to employ a less neutral word; we shall employ synonymously the two words "acquaintance" and "awareness," generally the former. Thus when A experiences an object O, we shall say that A is acquainted with O.

We will define a "subject" as any entity which is acquainted with something, *i. e.*, "subjects" are the domain of the relation "acquaintance." Conversely, any entity with which something is acquainted will be called an "object,"

i. e., "objects" are the converse domain of the relation "acquaintance." An entity with which nothing is acquainted will not be called an object. A fact will be called "mental" if it contains either acquaintance or some relation presupposing acquaintance as a component. Thus any instance of acquaintance is mental, since it is a complex in which a subject and an object are united by the relation of acquaintance. The object by itself need not be mental. We will call a fact "physical" when some particular, but no relation presupposing acquaintance, is a constituent of it. The reason for defining mental *facts* rather than mental *entities* is that we reach subjects only by description, and cannot know whether they are among objects or not.

It is to be observed that we do not identify a mind with a subject. A mind is something which persists through a certain period of time, but it must not be assumed that the subject persists. So far as our arguments have hitherto carried us, they give no evidence as to whether the subject of one experience is the same as the subject of another experience or not. For the present, nothing is to be assumed as to the identity of the subjects of different experiences belonging to the same person.

The strongest objection which can be urged against the above analysis of experience into a dual relation of subject and object is derived from the elusiveness of the subject in introspection. We can easily become aware of our own experiences, but we seem never to become aware of the subject itself. This argument tends, of course, to support neutral monism. It is a serious argument, and deserves careful consideration. We may attempt to meet it in either of two ways, namely by maintaining that we do have acquaintance with the subject, or by maintaining that there is no reason why, even if the theory is true, we should have acquaintance with the subject.

Let us consider first the theory that we have acquaint-

ance with the subject.[1] It is obvious that the question is bound up with that of the meaning of the word "I." This is a question in which confusions are very hard to avoid, but very fatal if they are not avoided. In the first place, the meaning of the word "I" must not be confused with the meaning of "the ego." "The ego" has a meaning which is a universal: it does not mean one person more than another, but rather that general characteristic, whatever it is, which makes each one of us call himself "I." But "I" itself is not a universal: on each occasion of its use, there is only one person who is I, though this person differs according to the speaker. It is more nearly correct to describe "I" as an ambiguous proper name than to describe it as a universal. But when used, "I" is not in the least ambiguous: it means the person using it, and no one else. In order, however, to obtain a clear statement of our problem, it is necessary to pare away from "I" a great deal that is usually included—not only the body, but also the past and future in so far as they may possibly not belong to the subject of the present experience. It is obvious that all these are obtained by an extension from the present subject, and that the essential problem is concerned with our consciousness of the present subject. Let it therefore be assumed, in this discussion, that "I" means the subject of the experience which I am now having (the vicious circle here is important to observe), and that we have to ask ourselves whether "I" in this sense is something with which we are acquainted.

On this question, it must be confessed that introspection does not give a favorable answer. Hume's inability to perceive himself was not peculiar, and I think most unprejudiced observers would agree with him. Even if by

[1] In a former discussion of this point, I maintained tentatively that we have such acquaintance. Cf. "Knowledge by Acquaintance and Knowledge by Description," *Arist. Soc. Proc.*, 1910-11, esp. pp. 110, 127.

great exertion some rare person could catch a glimpse of himself, this would not suffice; for "I" is a term which we all know how to use, and which must therefore have some easily accessible meaning. It follows that the word "I," as commonly employed, must stand for a description; it cannot be a true proper name in the logical sense, since true proper names can only be conferred on objects with which we are acquainted.

We are thus forced to investigate the second answer suggested above, and to ask ourselves whether our theory of acquaintance in any way implies a direct consciousness of the bare subject. If it does, it would seem that it must be false; but I think we can show that it does not. Our theory maintains that the datum when we are aware of experiencing an object O is the fact "something is acquainted with O." The subject appears here, not in its individual capacity, but as an "apparent variable"; thus such a fact may be a datum in spite of incapacity for acquaintance with the subject.

If it is true, as it seems to be, that subjects are not given in acquaintance, it follows that nothing can be known as to their intrinsic nature. We cannot know, for example, that they differ from matter, nor yet that they do not differ. They are known merely as referents for the relation of acquaintance, and for those other psychical relations—judging, desiring, etc.—which imply acquaintance. It follows that psychical data—at any rate those that are cognitive—consist not of particulars, but of certain *facts* (i. e., of *what certain propositions assert*), and of *relations,* namely acquaintance and certain others which presuppose acquaintance. We may distinguish sensation from perception by saying that the former gives *particulars* while the latter gives *facts*; in this case, introspection consists wholly of perceptions, not of sensations.

The definition of what is "mental" as what involves subjects is inadmissible, in view of the fact that we do not know what subjects are. We may define a mental fact as one involving acquaintance or one of those other relations—judging, desiring, etc.—which presuppose acquaintance. It *may* be that subjects are constituents of other facts of the kind we should call physical, and therefore a fact which involves a subject may not be always a mental fact.

When two objects O and O′ are given as parts of one experience, we perceive the fact "something is acquainted with both O and O′." Thus two instances of acquaintance can be given as having a common subject, even when the subject is not given. It is in this way, I think, that "I" comes to be popularly intelligible. When we have recognized that an experience is constituted by the relation of acquaintance, we may define "I" as the subject of the present experience, and we can see that, so defined, it denotes the same entity as is denoted by our former more popular definition. But in neither form does it require us to assume that we are ever acquainted with the bare subject of an acquaintance.

One very interesting and important point, however, remains to be investigated in the above definition of "I," and that is, what is meant by the "present" experience. If "I" is to be defined as we have suggested, it seems evident that the "present" experience must be known by acquaintance. There are here several points to be brought out. First, it is necessary to consider the connection (if any) between psychological presence and the present time. Secondly, it is necessary to consider what is psychologically involved in our acquaintance with the present experience. Thirdly, it is necessary to consider the logical difficulty of the vicious circle in which any definition of the present experience appears to be entangled.

1. Whatever I experience is, in one sense, "present" to me at the time when I experience it, but in the temporal sense it need not be present—for example, if it is something remembered, or something abstract which is not in time at all. The sense in which everything experienced is "present" may be disregarded, the rather as we already have three words—experience, acquaintance, and awareness—to describe what is meant by this sense. There is, however, another sense in which objects given in *sensation* are "present." As we shall find later, there is reason to suppose that there are several species of the general relation "acquaintance," and it would seem that one of these species is "presence" in the sense in which objects are present in sensation and perception but not in memory. The relation of "presence" in this sense is, I think, one of the ultimate constituents out of which our knowledge of time is built, and the "present" time may be defined as the time of those things which have to me the relation of "presence." But remembering what has been said about "I," we see that, when we speak of things which have the relation of presence to "me," we mean things which have the relation of presence to the subject of the present experience. Thus "the present experience" is a more fundamental notion than "the present time": the latter can be defined in terms of the former, but not *vice versa.*

2. What is psychologically involved in our acquaintance with the present experience? The least that is possible is obviously that there should be an experience of an object O, and another experience of experiencing O. This second experience must involve presence in the sense in which objects of sensation and perception are present and objects of memory are not present. Let us call this sense P. Then it is necessary that a subject should have the relation P to an object which is itself an experience, which we may

symbolize by S — A — O. Thus we require an experience which might be symbolized by

$$S' — P — (S — A — O).*$$

When such an experience occurs, we may say that we have an instance of "self-consciousness," or "experience of a present experience." It is to be observed that there is no good reason why the two subjects S and S′ should be numerically the same: the one "self" or "mind" which embraces both may be a construction, and need not, so far as the logical necessities of our problem are concerned, involve any identity of the two subjects. Thus "present experiences" are those experiences that have the relation of presence to the subject using the phrase.

3. But there remains a logical difficulty, of which the solution is both interesting and important. In order to know a present experience, it is not necessary that I should perceive the fact

$$S' — P — (S — A — O),$$

and it must be possible to pick out an experience as present without having perception of this fact. If it were necessary to perceive this fact, it is fairly evident that we should be embarked upon an endless regress. It is in fact obvious that "the present experience," or "the present object," or some phrase fulfilling a similar purpose, must be capable of being used as a proper name; all manner of objects are present on different occasions to different subjects, and we have already seen that the subject concerned in presence to "me" must be defined by means of presence.

The main consideration is undoubtedly to be derived from remembering what "presence" actually is. When an object is in my present experience, then I am acquainted

*or rather, $S' — P — [(\exists S).(S — A — O)]$.

with it; it is not necessary for me to reflect upon my experience, or to observe that the object has the property of belonging to my experience, in order to be acquainted with it, but, on the contrary, the object itself is known to me without the need of any reflection on my part as to its properties or relations. This point may perhaps be made clearer by an illustrative hypothesis. Suppose I were occupied, like Adam, in bestowing names upon various objects. The objects upon which I should bestow names would all be objects with which I was acquainted, but it would not be necessary for me to reflect that I was acquainted with them, or to realize that they all shared a certain relation to myself. What distinguishes the objects to which I can give names from other things is the fact that these objects are within my experience, that I am acquainted with them, but it is only subsequent reflection that proves that they all have this distinguishing characteristic; during the process of naming they appear merely as this, that, and the other.

Further consideration of the word "this" will help to make the point clear. The word "this" is always a proper name, in the sense that it applies directly to just one object, and does not in any way *describe* the object to which it applies. But on different occasions it applies to different objects. For the purposes of our present problem, we may say that "this" is the name of the object attended to at the moment by the person using the word. The relation of attention, here introduced, is of course different from that of acquaintance, and one point in which it differs is that a subject can only attend to one object, or at least a very small number, at a time. (This may of course be disputed, but for our purposes it may be assumed.) Thus we may speak of "*the* object of attention of a given subject at a given moment." The object so described is the object which that subject at that moment will call "this." But it

would be an error to suppose that "this" *means* "the object to which I am now attending." "This" is a proper name applied to the object to which I am now attending. If it be asked how I come to select this object, the answer is that, by hypothesis, I am selecting it, since it is the object of my attention. "This" is not waiting to be defined by the property of being given, but is given; first it is actually given, and then reflection shows that it is "that which is given."

We may now retrace our steps in the opposite order. At any moment of my conscious life, there is one object (or at most some very small number of objects) to which I am attending. All knowledge of particulars radiates out from this object. This object is not intrinsically distinguishable from other objects—it just happens (owing to causes which do not concern us) that I am attending to it. Since I am attending to it, I can name it; I may give it any name I choose, but when inventiveness gives out, I am apt to name it "this." By the help of reflection and special experiences, it becomes evident that there is such a relation as "attention," and that there is always a subject attending to the object called "this." The subject attending to "this" is called "I," and the time of the things which have to "I" the relation of presence is called the present time. "This" is the point from which the whole process starts, and "this" itself is not defined, but simply given. The confusions and difficulties arise from regarding "this" as *defined by the fact of being given,* rather than simply as given.

The objection to our theory of acquaintance which was derived from the absence of acquaintance with the subject is thus capable of being answered, while admitting that the objectors are in the right in maintaining that we are not acquainted with the subject. Having answered the objection, we can now retort on neutral monism with the

demand that it should produce an account of "this" and "I" and "now." I do not mean merely that it should produce an account of particularity and selfhood and moments of time; all this it might accomplish without in any way touching the problem. What I demand is an account of that principle of selection which, to a given person at a given moment, makes one object, one subject and one time intimate and near and immediate, as no other object or subject or time can be to that subject at that time, though the same intimacy and nearness and immediacy will belong to these others in relation to other subjects and other times. In a world where there were no specifically mental facts, is it not plain that there would be a complete impartiality, an evenly diffused light, not the central illumination fading away into outer darkness, which is characteristic of objects in relation to a mind? It may be that some answer can be found to these queries without admitting specifically mental facts; but to me it seems obvious that such "emphatic particulars" as "this" and "I" and "now" would be impossible without the selectiveness of mind. I conclude, therefore, that the consideration of emphatic particulars affords a new refutation, and the most conclusive one, of neutral monism.

Before leaving the analysis of experience, we must take account of a widely held theory according to which our acquaintance with objects involves not only subject and object, but also what is called "content." The distinction between content and object is set forth very explicitly by Meinong, for instance in his article "Ueber Gegenstände höherer Ordnung und deren Verhältniss zur inneren Wahrnehmung."[2] The following quotations from this article may serve to make the theory plain.

"That it is essential to everything psychical to have an

[2] *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*, Vol. XXI, 1899, pp. 182ff.

object, will presumably be admitted without reserve at least in regard to that psychical material which will here exclusively concern us. For no one doubts that one cannot have a presentation[3] without having a presentation of *something,* and also that one cannot judge without judging about *something.* People will probably also concede just as willingly that there is no presentation or judgment without content; but for not a few this readiness comes from the assumption that content and object are pretty much the same thing. I also long believed that the two expressions could be used indifferently, and that therefore one of them could be dispensed with. To-day I regard this as a mistake" (p. 185). He proceeds at once to give his grounds. The chief ground, he says, is that we may have a presentation or judgment whose object is non-existent, whether because it is self-contradictory, like the round square, or because, like the golden mountain, there happens to be no such thing, or because, like the difference between red and green, it is not the kind of thing which can exist, although it may "subsist," or because, though now presented, its existence belongs to the past or the future. He concludes: "Thus the presentation exists: but who, except in the interests of a theoretical preconception, will be willing to assume that the presentation exists, but not its content?" (p. 186). Thus the first difference between object and content is that the object may be something non-existent, but the content must exist when the presentation exists. A second difference is that the object may be not psychical, whereas the content must by psychical. The object may be blue or warm or heavy, but the content cannot have attributes of this kind (pp. 187-8). All presentations, however different their objects, have in common, he says, just what makes them presentations,

[3] I think the relation of subject and object in presentation may be identified with the relation which I call "acquaintance."

namely "das Vorstellen oder den Vorstellungsact"; but two presentations of different objects cannot be completely similar to each other, and therefore the difference in the objects must point to some difference in the presentations. Now that in which two presentations may differ in spite of the identity of the "act" is what is to be called the "content." This exists now and is psychical, even when the object does not exist, or is past or future, or is not psychical (p. 188).

Before deciding whether in fact there are "contents" as well as objects of presentations, let us examine Meinong's arguments in the above. The instances of non-existent objects quoted by Meinong are largely disposed of by the theory of incomplete symbols—the round square and the golden mountain, at any rate, are not objects. (I do *not* mean that they are objects which do not exist). The other instances are less intractable. The difference between red and green, for example, has the kind of subsistence appropriate to objects of this kind; and future things are not presented, although they may be known by description. Nevertheless, it remains the case that we can have a presentation of an abstract (which has no position in time), or of a remembered object which exists no longer. The case of memory suffices to illustrate Meinong's difficulty in the supposition that a presentation can exist when its content does not exist. We should say that we remember now, and in popular language we should say that we are in a different "state of mind" when we remember from that in which we should be if we were not remembering. Meinong's "content" is in fact what would commonly be called a "state of mind." Thus the question is: Are there "states of mind," as opposed to objects cognized in various ways? We are told that it is impossible the presentation should exist now, if its content does not exist now. But if presentation consists wholly and solely,

as we have contended, in a relation of subject and object, then a memory-presentation is a complex of which one constituent is present while the other is past. It is not clear that such a complex has any definite position in the time-series: the fact that the remembering subject is in the present is no sufficient reason for regarding the whole complex as present. And similar remarks apply to the case of presentations whose objects are not in time at all. Thus the question "who will be willing to assume that the presentation exists but not its content?" loses its force: the word "exist" is very ambiguous, but if it means "being at some part of the time-series," then it is not at all clear that the presentation does exist; and if it means any other legitimate meaning, it is not clear that the object does not exist.

The arguments that the content but not the object must be psychical, and that the object but not the content may have such attributes as blue or warm or heavy, may be passed by, since they do not afford any independent ground for believing that there are such things as contents.

The argument which has probably done most to produce a belief in "contents" as opposed to objects is the last of those adduced by Meinong, namely that there must be some difference between a presentation of one object and a presentation of another, and this difference is not to be found in the "act" of presentation. At first sight, it seems obvious that my mind is in different "states" when I am thinking of one thing and when I am thinking of another. But in fact the difference of object supplies all the difference required. There seems to be, in the hypothesis of "states" of mind, an operation (generally unconscious) of the "internal" theory of relations: it is thought that some intrinsic difference in the subject must correspond to the difference in the objects to which it has the relation of presentation. I have argued this question at length else-

where, and shall therefore now assume the "external" theory of relations, according to which difference of relations affords no evidence for difference of intrinsic predicates. It follows that, from the fact that the complex "my awareness of A" is different from the complex "my awareness of B," it does not follow that when I am aware of A I have some intrinsic quality which I do not have when I am aware of B but not of A. There is therefore no reason for assuming a difference in the subject corresponding to the difference between two presented objects.

It remains to inquire whether there are any other reasons for assuming "contents." I think perhaps belief in them has been encouraged by a careless use of such words as "image" and "idea." It may be thought that, when a given physical object is seen from many different points of view, the physical object itself is the object of many presentations, and that the different images are the different contents. Meinong himself is far from any such confusion, but language tends to encourage it. In fact, of course, the one physical object which is supposed to be seen from different points of view is a theoretical construction, and is not the object of any presentation. The objects of the various presentations concerned are the immediate visual data from the different points of view. The change in the visual data, combined with the belief that the physical object is unchanged, tends to generate the belief that the visual data are "subjective modifications," and thus to obscure their character as objects. I shall not enlarge on this subject now, as I have dealt with it at length in an article in *Scientia* for July 1914.

It may be urged that different people can know the same object, but cannot have the same presentation, and that this points to something other than the object as a constituent of a presentation. As against neutral monism, the argument is valid if its premise is granted; but in our

theory, the difference between the subjects suffices to distinguish the two presentations, and therefore no problem arises.

The chief argument *against* contents is the difficulty of discovering them introspectively. It may be said that this difficulty—which is admitted—applies equally to the subject in our theory of acquaintance. This is true; but our theory is based on inference from the nature of experience, not on any supposed introspective perception of the subject. If the arguments by which Meinong supports his belief in contents had appeared to us valid, we should have admitted contents; but in the absence of valid arguments introspective evidence alone could lead us to admit contents. Since such evidence is lacking, we may therefore conclude that there is no reason to admit contents.

The belief in "contents" as subjective modifications is often held in a more extreme form than that advocated by Meinong. It is thought that whatever can be immediately known must be "in the mind," and that it can only be by inference that we arrive at a knowledge of anything external to ourselves. This view may be combated in many ways. It would be well to know, first of all, what is meant by "my mind," and what really is being debated when it is asked whether this or that is "in my mind." We might next point out that abstract facts and universals may be known to many people, and that therefore, if they are "in my mind," the same thing may be in two minds at once. But I think the main source of subjective theories has always been the supposed illusions of sense. The sun, as it appears in astronomical theory, is not immediately given: what is immediately given is a certain visible bright patch, which according to physics depends upon the intervening medium and our sense-organs. Hence if we suppose that the astronomer's sun is the object when we "see the sun," then what is actually given has to be degraded to the level

of something subjective. But in fact, the physical object which the astronomer deals with is an inference, and the bright patch that we see, in spite of its variability, is only thought to be illusory as the result of fallacious arguments.

To sum up: The obvious characteristics of experience seem to show that experiencing is a two-term relation; we call the relation *acquaintance,* and we give the name *subject* to anything which has acquaintance with objects. The subject itself appears to be not acquainted with itself; but this does not prevent our theory from explaining the meaning of the word "I" by the help of the meaning of the word "this," which is the proper name of the object of attention. In this respect, especially, we found our theory superior to neutral monism, which seems unable to explain the selectiveness of experience. Finally we considered and rejected the opinion that experience involves mental modifications called "contents," having a diversity which reproduces that of objects—an opinion which appeared to rest upon the internal theory of relations; and along with this opinion we rejected—though partly by arguments which await amplification on another occasion—the doctrine that all immediate knowledge is confined to knowledge of ourselves.

BERTRAND RUSSELL.

CAMBRIDGE, ENGLAND.

CRITICISMS AND DISCUSSIONS.

GENTILE ELEMENTS IN CHRISTIANITY.

Inasmuch as Christianity in its beginnings was dependent on the Jewish religion it contains various doctrines and views which Judaism had previously adopted from other religions. But even without the mediation of Judaism other cycles of thought have exerted an influence on the original form of Christianity. Modern research in the history of religion has bestowed such zealous care on the determination of these foreign elements, that now there is no serious difference of opinion except with regard to the scope of the foreign elements. Our most eminent theologians, men like Harnack[1] and Gunkel,[2] call Christianity in plain words a syncretistic religion.

The dogmas derived from Parsism come decidedly first of all under consideration. We know that the Jews have borrowed from Parsism the doctrines of the immortality of the soul, of the resurrection and judgment after death, of heaven and hell, of the angels, and principally also of Satan, and that these originally Zarathustrian doctrines have found their way from Judaism into Christianity. If we ask about the period in which these entirely revolutionary religious views have penetrated into Judaism, the most obvious reply would be that the borrowing took place during the exile in Babylonia (which had been a Persian province since 538). But these assumptions which are so probable on *a priori*

[1] *Mission und Ausbreitung des Christentums in den ersten drei Jahrhunderten*, 2d ed., I, p. 261f. On pages 262-263 we read: "Since the middle of the third century Christianity is to be regarded as a syncretistic religion in the widest sense.... It was syncretistic from the very beginning on Gentile-Christian ground. It did not appear as a mere gospel but decked out with all that the Jewish religion had appropriated throughout its long history, accepting at once whatever might still be lacking. But now, about the middle of the third century, the new religion was ready for the first time as the syncretistic religion *par excellence*...."

[2] *Zum religionsgeschichtlichen Verständnis des Neuen Testaments.* Göttingen, 1903, p. 95.

grounds do not find support in the Old Testament. Belief in immortality and the resurrection is first established there at so late a date that we are compelled to give up the idea that Parsism exerted any appreciable influence on the Jewish religion during the exile. The belief in resurrection does not appear[3] until in the book of Daniel (165 B. C.), and then seems to be very generally diffused in the New Testament. But otherwise there is nowhere any mention of immortality, even in the post-exilic writings of the Old Testament—with one exception which, however, testifies exactly *against* a belief in immortality. The preacher Solomon is acquainted with the belief in it but is very doubtful whether it is justified (Eccl. iii. 20-21): "All go unto one place; all are of the dust and all turn to dust again. Who knoweth the spirit of man that goeth upward, and the spirit of the beast that goeth downward to the earth?" The Psalms, of which by far the greater part is post-exilic, know nothing of immortality, although it would have fitted so well into their line of thought. Accordingly therefore everything is in favor of the idea that these views first reached the Jews in the Grecian period—though not from Grecian quarters —but then quickly became popular with them.

Consequently I agree in this point with Van den Bergh van Eysinga who, following Erik Stave, does not regard the influence of Parsism on Judaism as a consequence of direct contact between Jews and Persians in the time of the Achaemenids, but explains it from the general spirit of the time which had prevailed since the days of Alexander.[4] From this standpoint we can also easily understand at once that the Parsi doctrines have not found entrance into later Judaism in their original pure form but in a mixture with foreign elements, especially the Babylonian. On this subject H. Zimmern says:[5] "Far more important than the Babylonian material, because exhibiting more striking parallels to the New Testament Christology, appear on the other hand, for instance, certain mythologemas of Parsism connected especially with the figure of Mithra. This naturally follows as completely established also from a purely chronological point of view. Nevertheless later Judaism in Babylonia came into particularly close contact with

[3] H. Gunkel, *op. cit.*, p. 32.

[4] *Indische Einflüsse auf evangelische Erzählungen*, Göttingen, 1909, 2d ed., p. 111. In a much later time Parsi elements have entered directly into Christian writings. Ernst Kuhn has published an interesting treatise in the *Festgruss an Rudolf von Roth* (Stuttgart, 1893, p. 217f) on the Christian garb in which the Zoroastrian prophecy of the future saviour has been dressed.

[5] *Zum Streit um die "Christusmythe,"* Berlin, 1910, p. 6; cf. also pp. 22, 50.

the Persian religion which lasted for centuries. Therefore we can easily account for the presence of Persian elements to a considerable extent, for instance, in the Messianic ideas of later Judaism. And yet, as has already been justly emphasized in various quarters, it was not the pure Iranian form of the Persian religion which exerted an influence on Judaism in Babylonia, but rather a form of Parsism within Babylonia in which many elements had found admittance from the older Babylonian religion already established there and which accordingly represents a mingling of Babylonian and Persian religious material."[6]

Nevertheless we must not estimate too highly these Babylonian admixtures of Parsism. What originally Babylonian ideas have finally found a place in Christianity are much more insignificant than is assumed by the noted advocates of Babylonism with Jensen at their head. Even the discreet and temperate Zimmern[7] seems to me still to overestimate the force of his parallels which to some extent cannot be compared with the parallel tales of Buddhism and the Gospels. Aside from details in Revelations which are based upon undeniably Babylonian ideas,[8] and from the demonology "which plays a great part in the time of Jesus as we learn from the Synoptists, and which strongly resembles that of ancient Babylonia,"[9] there remain, on careful consideration, hardly any other traces of the ancient Babylonian religion projected from the Judaic into the Christian religion than a few adornments of the Messianic picture and the day of rest at the end of the week of seven days.

Next in importance to the Parsi influences on Christianity stands the Hellenistic influence which is shown—especially, as is well known, in the Gospel of John and even more in the writings of St. Paul—in the introduction of the Logos as divine reason, in the identification of Christ with the Logos, in the doctrine of Christ's preexistence based upon it, and in sundry allegorical interpretations.

There are probably still other foreign influences on primitive Christianity which belong to those above mentioned, even though they can not be demonstrated with equal certainty—above all the frequently assumed influences of ancient Oriental forms of faith,

[6] Gunkel also expresses himself to this effect. See *op. cit.*, pp. 18, 30, 36, 76. Mithra is identified with Shamash.

[7] In Eb. Schrader, *Die Keilinschriften und das Alte Testament*, 3d ed., Part II, pp. 345f as well as in the pamphlet just cited.

[8] Gunkel, *op. cit*, pp. 3f, 42f.

[9] Gunkel, *op. cit.*, p. 29.

having for the object of their veneration a dying and reviving God, on the narrative of the death and resurrection of Christ. Largarde[10] says: "The death of Jesus transposes these ancient sages into a higher key from flat to sharp," and explains the belief in the resurrection of the Saviour as an unconscious transference of these ancient myths upon the beloved Master. Such deities appearing in the mythologies of neighboring lands, all of which probably represent nature dying in the winter and reviving in spring, are the Babylonian Tamuz, the Phenician Adonis, the Egyptian Osiris, the Phrygian Attis and the Greek (originally Thracic-Phrygian) Dionysus.

Among the primitive ideas universally diffused throughout the earth which have taken effect in the presentation of the life of Christ in the Gospels, we must count with equal probability the ideas of the necessity of a human sacrifice for the salvation of all and of the magic power of baptism with water and the notion of partaking of the god.

Nevertheless the conviction that all these foreign elements are recognizable in the New Testament and that there is no more history in our Gospels than perhaps—to select a convenient example for me—in the ancient Buddhist Pâli sources, does not admit of any doubt with regard to the historicity of the person of Christ. Though our Gospels may bear in part a legendary character, yet the powerful personality of Christ shines out from them in sharp outlines and complete distinctness with a doctrine and diction of its own. And although the most radical direction of modern Jesus research does not concede it, there is at least one argument which weighs more heavily than all the reasons put together in recent times for the historicity of Jesus, and which supplies a positively irrefutable proof for the historical Christ and for an authentic tradition from his own times which was utilized by the evangelists. I here set forth this reason in the words of Arthur Schopenhauer,[11] which are now mentioned but rarely and deserve to be called to mind:

"That our Gospels are based on the whole upon some sort of an original, or at least a fragment, from the time and environment of Jesus himself, I would conclude exactly from that prophecy which has proved such a stumbling-block, foretelling that the end of the

[10] *Deutsche Schriften,* 231.

[11] In the treatise "On Religion," *Sämtliche Werke,* Reclam ed., V, pp. 403-404.

world and the glorious return of the Lord in the clouds was still to take place during the lifetime of some who were present when the promise was given (Matt. x. 23; xvi, 28; Mark ix. 1; Luke ix. 27).[12] That these very promises remained unfulfilled is an excessively annoying circumstance which has not only made trouble in later times but caused embarrassments to Paul and Peter, as is discussed extensively by Reimarus in his very readable book *Vom Zwecke Jesu und seiner Jünger* (sections 42-44). Now if the Gospels had been written about a hundred years later without actual contemporary documents, good care would have been taken not to introduce prophecies of this kind which it was very clear at that time had conspicuously not been fulfilled. Nor would those passages have been introduced in the Gospels from which Reimarus with keen insight has constructed what he calls the first system of the disciples, and according to which Jesus to them was only a secular liberator of the Jews, if the writers of the Gospels had not worked on the basis of contemporary documents which contained such passages."

In mentioning the foreign religions which have furnished ingredients to Christianity, I have not yet mentioned India. I have set myself the task to investigate and present in an entire volume[13] the connections between India and Christianity in their historical and religious relations. I shall there have occasion to treat the much discussed question of Buddhist influences on the New Testament and hope to bring it nearer to a satisfactory solution, after having considered the interesting material for years without prepossession for either side. That generally speaking Buddhism is the only Indian religion that can come into consideration, and that Brahmanism has not exerted any influence on Christianity requires no proof; for Krishnaism which would be the only other possibility has sought and found no extension outside of the world of India.

The question of influences on the New Testament has an entirely different meaning in Buddhism than with respect to those religions which have had an effect on the origin of Christian dogmas. With respect to Buddhism the problem concerns entirely only

[12] It will not do to declare these passages ungenuine because we should ask in vain who could have had any interest in interpolating them. Cf. B. Weiss, *Die Religion des Neuen Testaments*, p. 309: "It is quite futile to try to do away by exegetical or critical violence with the fact that Jesus promised that he would return to his own generation."

[13] *Indien und das Christentum*, Tübingen, J. C. B. Mohr, 1914. An English translation is in preparation under the title *Christianity and the Religions of India*, and the present article is adapted from its Introduction.

the coloring of the life of Christ in the Gospels. On Christian doctrine itself Buddhism can not have exerted any considerable influence for the reason that as a religion it stands in sharpest contrast to Christianity in its preconceptions and dogmas. I need not enter into this any farther because it has been done often enough by those who are qualified[14]—and still oftener by those who are not qualified. Whoever will take the trouble to look through the *Orientalische Bibliographie*[15] will find dozens of books, essays and lectures on this subject.

That in spite of the above-mentioned relations the problem of Buddhist influence on the New Testament has long aroused a greater and more general interest than the question of other foreign influences on primitive Christianity, is mainly due to the striking similarity which many narratives and sayings in the earliest Buddhist and Christian sources exhibit in spite of the fundamental difference between the two great world religions.

Here we can barely touch upon those similarities between Buddhism and Christianity .in which the possibility of historical connection is excluded and so confirms a parallel independent development.[16] By this statement we do not intend to say that they are in themselves any less worthy of interest. Coincidences of this kind press in great number upon the attention of any one who will make comparisons. First of all we think of the analogous relation in which Buddhism and Christianity stand to the national religions of their home lands, to Brahmanism and Judaism, from which they have developed and which they have successfully resisted in order then to enter upon their world-subduing triumphal course—Christianity to the west and Buddhism to the east, so that now the silent ocean separates the realms of their expansion. Both re-

[14] I would emphasize the following treatises as particularly valuable: Nisikânta Chattopâdhyâya, "Buddhismus und Christentum," two essays in *Indische Essays,* Zurich, 1883, pp. 85f; A. Bertholet, *Buddhismus und Christentum,* 2d ed., Tübingen, 1909; L. von Schröder, "Buddhismus und Christentum, was sie gemein haben und was sie unterscheidet," in *Reden und Aufsätze,* Leipsic, 1913, pp. 85f, and the terse antitheses of E. Windisch in *Buddha's Geburt und die Lehre von der Seelenwanderung,* Leipsic, 1908, p. 217, 218. L. von Schröder, who places Christianity high above Buddhism, shows at the end of his above-mentioned essay that he is not blind to some advantages of Buddhism, but points out that with its undeniable gentleness and toleration towards other faiths it furnishes a mortifying model, and is distinguished by the fact that self-righteousness and religious pride are less common faults among its adherents than among Christians.

[15] Revised and edited by Lucian Scherman.

[16] K. E. Neumann, *Die innere Verwandtschaft buddhistischer und christlicher Lehren,* Leipsic, 1891, shoots far above the mark. Cf. Leblois, "Christianisme et Bouddhisme" in *Revue de l'histoire des religions,* XXIII, p. 351.

ligions assumed their missionary tendency and universal character very soon after their birth and show remarkable similarities also with respect to the development of doctrine and its establishment in great councils. Even the external form of the original doctrine corresponds in so far as the founders of both religions have preferably used popular comparisons and parables besides vigorous maxims. Windisch[17] has called attention to similarities in the literary form of the earliest Buddhist and Christian tradition. But all this is of less importance than the circumstance that both Buddhism and Christianity preach withdrawal from the world and its pleasures, with a pessimistic aspect in their judgment of the activities of the world; that they both are religions of salvation although they understand salvation in a very different sense, Buddhism as liberation from suffering and from the necessity of continued life, and Christianity as the liberation from sin and its consequences; and that almost the same demands in the moral realm are made by both religions, namely meekness, kindness, patience, mercy, forgiveness of wrong, yea, self-sacrifice and love of one's enemies. In all this neither of the two religions has copied the other. Everything has arisen independently.

RICHARD GARBE.

TÜBINGEN, GERMANY.

DEUSSEN'S PHILOSOPHY OF THE BIBLE.

EDITORIAL INTRODUCTION.

Professor Deussen's new book, *Die Philosophie der Bibel*, is a highly instructive, interesting and most comprehensive statement of the modern situation of Bible study. Properly speaking it is not a philosophy of the Bible, but Professor Deussen's own philosophy with reference to that collection of books which reverently we call "the Bible." The book is really a confession of faith and reflects the religious attitude of progressive mankind at the present date.

Professor Deussen has studied in Schulpforta. He has been trained in literary criticism and has incidentally learned to apply the scientific method also to the scriptures. While a university student at Bonn, he lost the rest of his dogmatic faith, but he regained the spirit of it in his philosophical studies, of which the most important documents to him were Kant's *Critique of Pure Reason* and Kant's *Critique of Practical Reason.* The former saved him

[17] *Buddhas Geburt*, 218, 219.

from the crude materialism of the materialistic world-conception, while the latter showed him how to base his faith not upon dogmatic views, but upon the fundamental facts of man's inner life, the cornerstone of which is conscience. In other words, we must rely not upon the historical figure of Christ, but upon the ideal of Christ, upon the Christ within us. This Christ within us constitutes the same source upon which all religious revelation must draw. Even Jesus and Paul relied in their life work on nothing else.

This view was by no means disturbed in Paul Deussen through a study of Schopenhauer's "World as Will and Idea." On the contrary, Schopenhauer's pessimism pointed out to him the significance of renunciation, a conception which was deepened by his study of the ancient religions of India. In this line, it is well known, our author gradually developed into the foremost authority, not only of the Sanskrit language but also of Sanskrit literature, above all in the study of the Vedanta. We have only to refer to the fact that Paul Deussen has written the clearest, the most comprehensive and most authoritative book on the subject under the title *The System of the Vedanta,* an English translation of which has recently been published by the Open Court Publishing Company.

Paul Deussen's philosophical views have been deposited in his "General History of Philosophy," but for people interested in Christianity he has now written the special book on "The Philosophy of the Bible" because it treats a subject that is of great practical importance for every man of western culture. We can not characterize his book better than in his own words, and so we here reproduce in translation the greater part of his foreword.

Upon the whole we fully indorse Professor Deussen's ideas, especially his historico-critical methods upon which his results are based, but there are several points of smaller importance where we beg to state a difference of opinion.

A basic difference, which however is of little consequence for the present purpose, is this, that in the contrast between the Brahman and Buddhist views Professor Deussen takes the former, the Vedanta conception of the *atman,* which means that the self, or man's soul, is a being in itself, while we deem the Buddhist conception of the non-existence of a special independent *atman* to be in full agreement with the most matured scientific psychology of to-day. Yet we grant to all the adherents of the belief in an *atman* that a unification of ideas constitutes a real factor of utmost importance, so that we really concede that soul-life in its practical

application acts as if there were an independent self, an additional superimposed unit, a systematic direction of the whole. The co-operation of parts creates something absolutely new, as every one will know who holds a watch in his hands in which by a mishap something has become twisted so that it will not go. But when it is in good order and all its parts interact, it is as if a soul had been put into it; and it is this soul, this *atman*, this unity of the parts which is the most important part of the watch. Nevertheless we entirely agree with the Buddhist philosophers that this highly important unity is not any special concrete being, but is simply that non-material cooperation, that harmony which prevails among the parts.

This difference is fundamental and makes us reject dualism in every form. We recognize the paramount significance of spirit, we do not deny the contrast between matter and mind, and we insist on ethics as rising above hedonism and involving altruistic aspirations and self-sacrifice; but all this, all higher life, the germ of life, man's mind and even his conscience rises from nature in a continuous ascent, and we boldly claim that there is nought of it that is not explainable on purely scientific ground.

In addition to this fundamental difference between Professor Deussen's and our own views, we will mention a few trifling details that occur in the present article. Professor Deussen voices the common view that Christianity has grown out from the life of the people of Israel. We believe that Christianity has developed from the religious life of the Mediterranean pagans. Christianity is the belief in a God-man, in the Saviour, who being the son of God himself has been incarnated, walks on earth, helps mankind by good deeds, by instruction, by healing the sick, helping the poor and doing miracles, but his enemies intrigue against him and succeed in putting him to death. Thereupon, he rises from the grave and will come back to judge the quick and the dead. This same story is the tale of all the pagan gods. Thor the Teutonic god walked on earth unknown. Osiris having been killed by his enemies becomes the judge of the dead in the underworld. He is revived again in his son Hor, the child. The same story of the dying and resurrected god is told of Adonis in Syria, of Marduk in Babylon and of many other divinities of the ancient pagans. This belief had been cut out from the national faith in ancient Israel by rationalists who refused to accept the strange methods, perhaps justly, to be branded as superstitious. The faith of the ancient

Israelites was not different from the religion of the surrounding Gentiles, but after the great temple reform, recorded in 1 Kings xviii., the leading party struck out the hope of immortality, and the idea of a humanized God. The very idea of a son of God became blasphemous to them, as it was later on to Mohammed. Christianity in our opinion would have originated under all circumstances in the same or a similar way even if Judea had never existed. It might not have been called Christianity, but certainly the world religion of the Mediterranean people with all its dogmas of the trinity, of the God-man, of divine incarnation, and also with its dualistic ethics, would have been the same as in Christianity even if the new faith had not been hitched on to the Jewish traditions. A religion of the nature of Christianity was developing at the time of Christ, and it is not at all astonishing to recognize in the religion of Persia a kind of pre-Christian Christianity.

We recognize with pleasure the great importance which Professor Deussen attributes to the part played by Zarathustra in the formation of Christianity.

As to the question "Are we still Christians?" we believe that it can not be answered by any positive yes or no. The question suggests an attitude, and the problem of to-day is not so much whether or not there is any justification for us to continue the use of the name, but whether or not the Christianity of to-day has the intrinsic power to adapt itself to the demands of the present time. Christianity has changed often during the course of its development. In the beginning it insisted on doctrines which are now absolutely forgotten. In some phases of the aboriginal Christian belief the eschatological expectations were so pressed into the foreground that Christianity seemed to exist only on their account. In other phases of the development of Christianity the resurrection of the body was emphasized in contrast to all other beliefs in immortality, and so we have throughout the history of the church one or another dogma standing in the forground, which in the course of time has been forgotten and superseded by other questions which again were themselves of transient significance. There was a time when Christianity was supposed to stand and fall in the belief in the flatness of the earth, and even such a reformer as Luther condemned Copernicus outright as a fool who did not hesitate to subvert not only theology and the revelation of God but also science itself.

The present problems of Christianity are by no means more radical than former ones, only we are becoming more and more

conscious of the difference between a scientific world-conception and another one based upon sentiment, upon anti-scientific tendencies, or at any rate upon non-scientific data, and in answering this question we do not deem it our duty to choose between the two horns of the dilemma. It seems to us that the question is whether or not the future generation will break with traditional Christianity, and the answer will be that Christianity as represented by the churches will gradually adapt itself to new conditions. It will accept the results of science as a matter of course, and will look upon generations which still objected to science, as narrow and misguided. How long it will take for the leaders of the church to make a compromise and to concede to science what belongs to science will be difficult to say, but it is sure to take place in theUnited States where the churches depend upon the congregations, while the same process will be retarded in Europe, especially in England and Germany, as long as the state church represents established traditionalism while the people's religion becomes more and more alienated from it. The result, however, will finally be the same. In the United States the transition will be gradual, while in Europe, especially in Protestant Europe, there may be a revolution of the people who will clamor for the abolition of state churches. P. C.

DEUSSEN ON THE BIBLE IN PRESENT THOUGHT.

David Friedrich Strauss, the author of the famous *Life of Jesus,* distinguished as a critic but not so well equipped as a philosopher, raises the question, "Are we still Christians?" in the work of his old age, *Der alte und der neue Glaube,* and answers it with a clear and positive "No." But the person who can pick out the philosophical kernel from the historical and therefore accidental shell, who is not stopped by mere words and can recognize a thing even when it appears under a different name and in a new dress, that man after all the achievements of historical research, natural science and philosophy, will answer the question which Strauss raised and answered in the negative, "Are we still Christians?" with an equally clear and positive "Yes." For the essence of Christianity extends much farther than its name, and consists in an idea that is as everlasting as the universe and will never die away. This is the Indian-Platonic-Christian idea that our earthly existence is not an end in itself, as all eudemonic ethics assumes, but that on the contrary the supreme task of life consists in purging ourselves of the selfishness inborn in us all by the path of self-

denial which constitutes the essence of all genuine virtue, and in so doing to consummate our eternal destiny, which, however, remains unknown to us and must so remain if the purity of moral action be not imperilled.

He who has grasped in its greatest depth this idea in which consists the peculiar essence of Christianity will no longer hesitate to give unto science that which is science's, even though in so doing he must sacrifice many ideas which comprised the joy and consolation of our fathers, because they cannot be reconciled with a scientific comprehension of the universe.

Since we are no longer limited to sources like the Bible and Herodotus for the history of Israel and of Christianity which has grown out of it, many things connected with the Bible have acquired a different aspect through the deciphering of the hieroglyphs and of the Babylonian and Assyrian cuneiform writings, the inscription of King Mesha, the discoveries in Tel-el-Amarna and Elephantine, and a more exact knowledge of the Iranian world-conception.

Since the monuments of ancient Egypt speak to us again after the silence of a thousand years the old dream of an Egyptian primitive wisdom (Acts vii. 22) has vanished and with it the possibility of deducing Hebrew theism from that of the Egyptians which was a very different kind. On the other hand Assurbanipal's library contains well-authenticated prototypes from which the myths of the creation of the world, of paradise, of the ten patriarchs and above all of the deluge have developed under the hands of the ancient Hebrews in a significant ethical transformation upheld by the spirit of prophecy.

On the other hand, the letters of Tel-el-Amarna tell us about an empire of Mitani whose rulers bore Iranian names as early as 1400 B. C., whence it becomes possible to refer to an Iranian source the myth of the fall of man which we find in the Yahvist redaction (850 B. C.). These Amarna letters give us a picture of the condition of Palestine before the time of the Hebrew invasion into which the narratives of Abraham, Isaac and Jacob which are of such great ethical value can in no wise be inserted, so that we must renounce all historical certainty with reference to the three patriarchs.

But we shall be compelled to abandon still other ideas that have become dear to us. For if it can hardly be doubted any longer that Deuteronomy is the law book of King Joshua (621 B. C.)

and that Leviticus together with its adjacent portions is the code of the second temple, proclaimed by Ezra and Nehemiah (444 B. C.) what then remains of Moses except the hazy figure of a mythical hero to whom we can refer only the first organization of the Hebrews wandering around in the desert as Bedouins, and with it the first rudiments of the later legal code? The timorous rôle which legend makes him play when he is called to be leader of the children of Israel will not tally with his powerful and often violent appearance as legislator. In general the entire sojourn of Israel in Egypt and the catastrophe at its exodus become very uncertain from the fact that Egyptian monuments seem to know nothing of either.

We do not tread firmer ground until after the successful conquest of the promised land in the time of the judges and the first kings. There are many passages in the Old Testament that go to prove that in this period other gods besides Yahveh were worshipped as the tutelary deity of Israel, and that the claim of monotheism was first raised by the earlier and finally successfully carried out by the later prophets. An invaluable complement to these passages is found in the inscription of King Mesha of the Moabites, which shows that Yahveh was for the Hebrews, just as Kamosh for the Moabites, the special tribal deity to whom worship and allegiance were due, and to whom the other gods stood in the same relation as strange kings to the king of his own land, for while obedience is not due them, yet no one doubted their actual existence.

At first the Israelites became gradually encouraged to declare in the crude way which we find in Deutero-Isaiah that all other gods were stone and wood, and to proclaim Yahveh as the only real God, to whom was referred the creation of the universe, and with it very consistently also the authorship of evil, and as whose creature, with equal consistency, man was created out of nothing and sank again at death into his original nothingness. These views of God and man were not at all suited to become the foundation of a universal religion. For this end the ancient Hebrew concepts required a transformation that was not possible from the heart of ancient Hebraism alone but could be accomplished only through the infiltration of a foreign element.

Thus we would have to postulate and construct hypothetically a new element as a medium between the Old and the New Testaments if such a one did not lie plainly before our eyes in the

Iranian world-conception of Zarathustra. A picture of this religion of the great and mighty empire of Persia to which the Jews were subject for two centuries must therefore be introduced into our exposition and on this basis we shall show how it first became possible through Iranian influence to exonerate God from the authorship of evil and to establish him as the principle of morality, while to this same influence was due also the consciousness of the eternal destiny of man and a spiritualization of the Messianic hopes.

Thus was the ground prepared for the appearance of Jesus, whose life can be presented only on the basis of the three synoptic gospels with the complete exclusion of the fourth, if we would not forego the possibility of obtaining a historically established and psychologically consistent idea of the unique personality of Jesus as well as of his teaching, in comparison with whom a Buddha would seem insipid and a Socrates cold.

Further it can not be too strongly emphasized that St. Paul relies upon his own revelations, that consequently the Pauline Christ upon which the church's figure of Christ rests is originally not an historical but an ideal Christ. The need to see this exemplified in the life of Jesus led to the composition of the Fourth Gospel which, as our exposition goes to prove, rests altogether on a Pauline basis and hence comprises the latest but also the most mature and the most universal document of the New Testament.

The last chapter of our book makes the attempt to separate the imperishable kernel of Christianinty from the perishable shell, whereby the deep intrinsic relation of this kernel to the fundamental views of the philosophies of Kant and Schopenhauer becomes clearly evident. In consideration of this kernel which regards moral consciousness as the only source of revelation with its remarkable phenomena of the categorical imperative, the freedom of the will and responsibility, the instinctive approval of the good and rejection of the bad in others as in ourselves, but which contains in these metaphysical facts which are not explainable from nature, the whole and positive gospel of an everlasting empire which lies beyond this world of phenomena, we may dare even after the undermining of faith in the Bible by historical and scientific criticism, to answer the question raised at the beginning, "Are we still Christians?" by a confident "Yes!"

* * *

[Professor Deussen accepts the principles of higher criticism, and would not oppose the truth of science in whatever form it may

present itself; yet he wishes to keep the religious spirit of Christianity, and among other things his admiration for Jesus. So he retains the philosophical elements of the doctrine of Jesus while he sacrifices the traditions. It will be interesting to add to Professor Deussen's general comments his explanation of the resurrection (pages 226-228):]

Faith in the resurrection of Jesus has become the foundation for the origin of the Christian church. How this belief could have arisen among the discouraged disciples mourning the loss of their master can only be conjectured from the contradictions and confused state of parts of the Gospel tradition. But if we would not go so far as to dispute the credibility of the Evangelists' accounts, if we would not assume that it had all been arbitrarily fabricated at a later time when no one could verify the rumors by the actual state of things, still two facts seem to stand out with historical certainty from the midst of the legends in which they are framed: first, that Jesus actually died on the cross, for it would be impossible for the belief in a triumphant and glorious resurrection could have been connected with the survival of a weak personality enfeebled by suffering of all sorts; and second, that the women who came on the morning after the Sabbath to anoint the body found the grave empty in which they supposed it to be, a fact which gave rise to the belief that the Lord, newly risen, had departed from the grave, and later to the rumor that he had been seen in various places. But we can only surmise how to account for the strange chance—or, if you prefer, the dispensation—by which the women found the grave empty. That the disciples should have secretly stolen their master from the grave and thereupon have founded the report of his resurrection, is so very contradictory to their later ethical conduct that such a possibility, suggested in Matt. xxvii. 64, must be absolutely rejected. But still it seems to me that we can not get around the probability of a small *pia fraus*. For when the rumor spread that the Lord was arisen there were some, or at least one, who knew how the matter stood, namely the one who had either disposed of the body elsewhere from the first or, if the women were really supposed to have been present at the burial, who had taken it away from there and had buried it in another place, though whether at the direction of Joseph of Arimathea or for other reasons we cannot say. Some one therefore must have known where the body was to be found because he himself had brought it there, but this one kept silent when the rumor of the

resurrection arose, and the fact that he kept silent is the small *pia fraus* which apparently is not to be passed by.

Of course we have not only the imaginative and inconsistent accounts of the gospels with regard to the appearance of Christ after the resurrection but we have also a testimony which weighs more heavily than all of them, namely that of St. Paul of whose reliability as an *anima candida* there can be no doubt and who thus expresses himself in 1 Cor. xv. 3-8:

"For I delivered unto you first of all that which I also received, how that Christ died for our sins according to the scriptures; and that he was buried, and that he rose again the third day according to the scriptures; and that he was seen of Cephas, then of the twelve; after that he was seen of above five hundred brethren at once; of whom the greater part remain unto this present, but some are fallen asleep. After that, he was seen of James; then of all the apostles. And last of all he was seen of me also, as of one born out of due time."

The last of the six appearances of Christ mentioned by Paul, the one which befell himself, furnishes us with the key to all the rest. In view of St. Paul's natural inclination towards ecstasy, it is comprehensible how a subjective vision might appear as an objective occurrence to his emotional disposition, convulsed by violent internal struggles and transformations, when he thought he had seen objectively in the flesh the Lord whose followers he had so zealously persecuted and to whom he surrendered himself in a sudden conversion with the whole fervor of his ardent temperament. Of such a kind must also have been those earlier appearances, not only the one to Peter and Jacob but also to the twelve disciples and even the five hundred brethren, for it is a psychological fact confirmed by instances from all lands and times that in a gathering of sympathetic people religiously stimulated the visions which appear to one or another can exert a certain contagion and communicate themselves to all present.

IN MEMORIAM CHARLES S. PEIRCE.

(Born 1839, died 1914.)

Concerning genius, its advent discovery and nurture, history informs us that with rare exceptions its worldly case is one of the utmost austerity. On reflection this appears not at all strange.

Pro re nata, genius issues as an outlaw. It breaks over and through the accustomed rules and conceptions to the confusion and perplexity of a world otherwise comfortable in conventions regarded by it as settled possessions. Hence it is unwelcome. Hence the futility of all extant provisions in its favor. Had any Nobel foundation been in existence in 1841, would any of its benefits have found its way to Hermann Grassmann? Not in a thousand years. His case is typical of the general case of genius. Neglect and poverty are its portion in life. Then afterwards lapse of time reveals to a stupid, jealous and oftentimes spiteful world that it has conspired for the suffocation of a divine messenger.

In the late sixties the distinguished Prof. Benjamin Peirce of Harvard, lecturing before the Boston "Radical Club" on "The Impossible in Mathematics," spoke of his son Charles and of his expectations that the latter would develop and fertilize the vistas he had been able only to glimpse. On April 19, 1914, after at least a half century of assiduous probings into the most recondite and the most consequential of all human concerns, in a mountain hut overlooking the serene Delaware, in privation and obscurity, in pain and forsakenness, that son, Charles S. Peirce, left this world and left also a volume of product the eminent value of which will sooner or later be discovered, perhaps only after it has been rediscovered. For his issues have so far anticipated the ordinary scope of even professional intellectual exercise that most of them are still only in manuscript. Publishers want "best sellers." At least they want sellers that will pay the expenses of publication, and buyers of printing that calls for laborious mental application are scarce. Let me here with the utmost solicitude beg all to whom it falls to handle his books and papers to beware how they venture to cast away any script left by him.

Is this panegyric unwarranted? If so, then why should Professor James in his *Varieties of Religious Experience* call Mr. Peirce "our great American philosopher"? Why should Professor Schroeder base his great work "Exact Logic" on the prior work of Mr. Peirce? Why should the editors of the great *Century Dictionary* employ Mr. Peirce to write so many of its logical, mathematical and scientific definitions? Why should the editors of Baldwin's Dictionary make a similar draft? Why should the editors of the *New York Evening Post* and of *The Nation* for years refer their books of serious import to Mr. Peirce for examination and review? Why should Dr. Carus recognize in Mr. Peirce a foeman

worthy of his incisive steel on the fundamental problem of necessity?

Of course genius is unconformable. "'T is its nature to." It is often very hard to get along with. It tries the patience to the limit. It is so immersed in and so saturated with the inspiration of non-conformity that it often neglects to observe what is really and plainly only a merely defensive right on the part of the world of conformity. There ought to prevail a mutual spirit of forgiveness. If much is to be forgiven because of much love why should not much be forgiven to much promising and well directed power?

Mr. Peirce died a faithful man. His earlier studies led him far towards the goal of materialism, but in the course of those studies he was led to the discovery of that touchstone of values, that at first until the conception and word became mangled and aborted out of its true intent and utility he called Pragmatism, the principle that all rational significance of conceptions and of the terms embodying the same lies between the four corners of their *conceived* consequences in and to actual practice mental and otherwise. Since all logic is only a comparison and criticism of conceptions, this principle affects and effects our whole rational life and conduct. He was thus led to his conception of *reality* as that which has the natural prerogative of persistence as a possession forever. He perceived that intellectual entities, like, say, the law of gravitation or the ratio of the radius to the circumference of a circle, have just as abiding a persistence as any material entity and hence just as *real* an obtaining. Hence actual medieval realism, when better introduced and explained, is more pragmatically valuable than any case of nominalism or conceptualism can possibly be. The recognition of ideal realities opens out into the recognition that all existence is grounded in and upon that ideal substance the best names for which are *Form,* alias *Reason,* alias *Mind,* alias *Truth,* alias *the Good,* alias *Beauty.* The perception of Reason immanently in and throughout the universe and identical in nature with human reason solves at once the vexed question of the relation of body and mind, invites the soul to faith and repose and at the same time stimulates the soul to a vivid aspiration after cooperation with the Universal Spirit in accordance with its course of procession.

So lives Charles S. Peirce. The Universal Spirit has him and

the world that neglected him will care for him—after many days perhaps, but most assuredly.

FRANCIS C. RUSSELL.

CHICAGO.

ASSOCIATED PRIME NUMBER MAGIC SQUARES.

Associated magic squares are those in which any two numbers that are placed symmetrically equidistant from the center of the square are equal in summation to any other couplets so situated. When n is an even number these squares are necessarily constructed entirely of couplets, but when n is odd, the central cell contains the middle number of the series, and all other numbers are arranged in couplets.

ASSOCIATED MAGIC SQUARES IN WHICH n IS ODD.

As in the case of paneled magics it is necessary to find $4+8+12.....+2\ (n-1)$ couplets, each couplet summing twice a certain prime number which must occupy the central cell.

Since all magic squares of the 3d order are associated and constructed from the same formula, the square shown in Fig. 1 and first made by Mr. Henry E. Dudeney (1900) has the lowest possible summation, $S = 111$.

67	1	43
13	37	61
31	73	7

Fig. 1.

491	263	23	419	59
149	191	461	53	401
71	269	251	233	431
101	449	41	311	353
443	83	479	239	11

Fig. 2.

1223	881	419	179	311	461	1013
1151	173	89	1259	191	443	1181
251	521	683	773	1277	263	719
929	233	1229	641	53	1049	353
563	1019	5	509	599	761	1031
101	839	1091	23	1193	1109	131
269	821	971	1103	869	401	59

Fig. 3.

For squares of the 5th order twelve couplets are needed and an associated magic square of this order is shown in Fig. 2, $S = 1255$.

Squares of the 7th order require twenty-four couplets, and Fig. 3 is an example, having a summation of 4487.

911	1571	1427	1373	857	1913	2141	1097	1013
863	2213	2267	1181	2441	23	653	2621	41
5	647	947	2633	1151	1907	317	2423	2273
1511	2381	71	1973	1301	2351	2477	191	47
1451	887	2243	401	1367	2333	491	1847	1283
2687	2543	257	383	1433	761	2663	353	1223
461	311	2417	827	1583	101	1787	2087	2729
2693	113	2081	2711	293	1553	467	521	1871
1721	1637	593	821	1877	1361	1307	1163	1823

Fig. 4.

Fig. 4 shows an associated magic square of the 9th order in which forty couplets are used, the summation being 12,303.

ASSOCIATED MAGIC SQUARES IN WHICH n IS EVEN.

These squares demand the use of $n^2/2$ couplets, but these couplets are not required to sum twice a given prime number as in squares where n is odd, which fact accounts for their lower summations in proportion to values of n.

It is capable of algebraic proof that an associated magic square of the fourth order must be constructed from a balanced series of numbers as shown in Fig. 5. The smallest series of prime numbers,

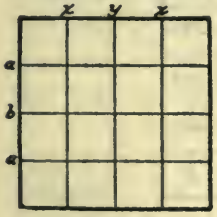

Fig. 5.

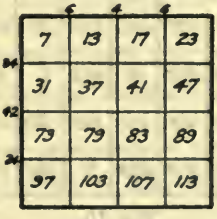

Fig. 6.

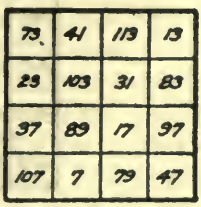

Fig. 7.

filling this requirement, is given in Fig. 6, and Fig. 7 shows an associated magic square made therefrom with $S = 240$. It is believed that this square was first made by Mr. L. S. Frierson, December 25, 1911.

An associated square of the 6th order requires eighteen couplets, and an example of this square, S = 630, is given in Fig. 8.

197	71	83	79	37	163
17	97	109	29	179	199
167	151	53	137	103	19
191	107	73	157	59	43
11	31	181	101	113	193
47	173	131	127	139	13

Fig. 8.

271	1	227	353	421	503	163	101
491	439	151	337	113	311	61	137
269	383	47	197	233	11	443	457
131	23	479	281	401	79	179	467
43	331	431	109	229	31	487	379
53	67	499	277	313	463	127	241
373	449	199	397	173	359	71	13
409	347	7	89	157	283	509	239

Fig. 9.

For a square of the 8th order, thirty-two couplets must be used as shown in Fig. 9. S = 2040. For certain arithmetical reasons a pandiagonal magic square of the 10th order cannot be made

953	607	113	349	919	317	181	337	827	347
127	257	751	421	727	659	947	907	23	131
167	757	571	929	137	971	103	7	761	547
397	109	359	179	739	389	719	977	373	709
557	307	541	911	491	677	839	107	53	467
523	937	883	151	313	499	79	449	683	433
281	617	13	271	601	251	811	631	881	593
443	229	983	887	19	853	61	419	233	823
859	967	83	43	331	263	569	239	733	863
643	163	653	809	673	71	641	877	383	37

Fig. 10.

from a series of consecutive numbers,[1] and for similar reasons, an associated square of this order cannot be made from a series of

[1] See "Notes on the Construction of Magic Squares of Orders in which n is of the General Form $4p + 2$," by W. S. Andrews and L. S. Frierson, *The Monist*, April 1912, Vol. XXII, No. 2, p. 304.

couplets, the summation of which, individually, is evenly divisible by 4. Fifty couplets are required for a square of this order, and fifty-one can be found summing 840, but for the above reasons they are inadmissible. Fifty other couplets can, however, be found which individually sum 990, which is not evenly divisible by 4 and can therefore be used. An associated magic square made therefrom is shown in Fig. 10.

The writer believes that all of the associated magic squares mentioned in this article show the lowest possible summation.

CHARLES D. SHULDHAM.

WYOMING, N. J.

CURRENT PERIODICALS.

In the *Revue de Métaphysique et de Morale* for March, 1914, L. Dugas gives the text and variants of, together with a commentary on, the fragment *La Feuille de charmille* of the philosopher and poet Jules Léquyer, of whom one of his friends, Le Gal La Salle, said: "He has left pages worthy of the greatest thinkers; he has not taken rank among them." An American mathematician, A. R. Schweitzer, studies the guiding ideas of genetic logic of mathematics. Viewing mathematics as a science of discovery, the author attempts a general description of its logical position, the establishment of parallels between certain mathematicians and certain philosophers—such as Grassmann and Herbart and Schleiermacher—and the examination of examples of mathematical "activity." To compare, as the author does, the definition of mathematics given by Bertrand Russell in his *Principles of Mathematics,* which is a description of the logical nature of mathematics itself, with the definition, given by C. S. Peirce, of mathematics as the discovery of certain relations, seems to overlook the clear distinction that has existed since Kant between logic and the theory of knowledge on the one hand, and psychology on the other. Take an analogy: it is the concern of chemistry to analyze a given chemical compound; not to decide how it was brought into the laboratory. Examples of the guiding ideas of mathematics are then illustrated and discussed. (1) The principle of comparison is, in the words of E. H. Moore, that "the existence of analogies between central features of various theories implies the existence of a general theory which underlies the particular theories and unifies them with respect to those central features." (2) The principle of continuation is

that the existence of a class of particular elements (or *operanda*) which are subject to certain particular operations implies the existence of a class of general elements subject to general operations. (3) Mach's principle of economy requires that every scientific end be attained with the minimum expenditure of thought. (4) The principle of special situation is a particularization of the principle of continuation. The guiding ideas of mathematics are the same as those of non-mathematical disciplines, but mathematical ideas have a distinctive character, owing to the fact that they are perceptive in their nature; and there is, in essentials, only one guiding idea in mathematics: the principle of comparison. It is pleasant to see the growing tendency towards a union of science and philosophy: in this article we meet with citations from *Mind* and *The Monist* by the side of citations from *The Quarterly Journal of Mathematics* and *The Bulletin of the American Mathematical Society.* Xavier Léon continues and concludes his article on the socialism of Fichte according to *Der geschlossene Handelsstaat.* Edmond Laskine has a critical study on the transformations of law in the nineteenth century. G. Lechalas has a note on the remarkable infidelity with which painters often reproduce the rainbow. S. Ginzberg and Louis Couturat continue a discussion on particular propositions. Georges Guy-Grand writes on foreign politics and democracy. The usual supplement contains notices of events in the philosophical world, new books, periodicals and theses.

* * *

The first number (January, 1914) of Vol. XV of *Scientia* (*Rivista di Scienza*) is a particularly interesting one. Beginning with this number, *Scientia* is printed on better quality and lighter paper, the edges are cut, and the number of pages remains the same. The first article is by H. H. Turner and is on "The Periodicities of Sun-Spots (A reply to Mr. E. W. Maunder)." In *Scientia* for January, 1913, Maunder had stated his view that "the sun-spot period is essentially one: there are no sub-periods: there are no multiple periods..."; and here the author criticizes Maunder's use of the term "periodicity." M. Abraham writes most clearly and instructively on the new mechanics. The principles of the old mechanics of Galileo and Newton—in particular the second and third laws of Newton—allow us to describe the motions of masses under the influence of their mutual gravitation, but do not suffice when the forces of electricity and magnetism, of light and

of heat come into play; and the *Principles of Mechanics* of Heinrich Hertz closes the phase of evolution which wished to bring the whole of physics under the old mechanics. Yet certain principles of mechanics (Lagrange's equations and the principle of least action—presumably this means Hamilton's principle) keep their value in the new mechanics when we generalize the expression of Lagrange's function and of "action." The question as to how it is that optical experiments with light from terrestrial sources do not show any influence arising from the earth's motion (Michelson) was examined by Lorentz (1892-1904) and resulted in the notion of "local time" and "the hypothesis of contraction," the latter being independently due to Fitzgerald. To be distinguished from this theory of Lorentz's is the theory of relativity set up by Einstein in 1905, which decided that the traditional ideas of geometry and kinematics have no signification. This theory is founded on two postulates: (1) the equivalence of systems having a uniform motion of translation with respect to one another; (2) the propagation of light in space is effected with the same velocity in all directions. This theory, which was developed mathematically by Minkowski in 1908, was, for the most part, regarded with scepticism by physicists whose philosophy was formed under the influence of Mach and Kirchhoff. There is a very illuminating comparison of the theory of relativity with the theory of Lorentz. The crisis of the theory of relativity began when this theory undertook to make gravity enter into the domain of its considerations, and both in Einstein's theory of 1905 and in that of 1913 gravity is an unsurmountable obstacle. Still, the theory has an honorable place in the history of the criticism of the conceptions of space and time; it has assured for itself, at any rate, an "honorable burial." But, whatever the fate of the theory of relativity, the new mechanics will continue to develop. Its object is to keep mechanics in touch with the other disciplines of physics. Augusto Righi gives a short account of recent results and conclusions as to the nature of the X-rays. They seem most probably to be of the same nature as the rays of light, and thus to be a manifestation of electromagnetic waves in the ether. Marcus Hartog writes on "Samuel Butler and recent mnemic biological theories." The main thesis of Butler's *Life and Habit* (1877) had been anticipated by Hering in 1870 (*Memory, etc.*, Eng. Trans., 4th ed., Open Court Publishing Co., Chicago and London, 1913), and Butler, when he got to know this, wrote *Unconscious Memory* (1880, 1910). The development of

Butler's views in these works, in *Luck or Cunning,* and in the *Notebooks,* is traced, and the facts are thus summed up: "Butler popularized the teaching of Hering before its existence was known to him, anticipated Semon in his detailed comparison of memory with heredity, and from a small suggestion of Hering's, planned out a physical explanation of memory in terms of vibrations, which was destined after his death to be more fully elaborated by Rignano (*The Inheritance of Acquired Characters,* Eng. Trans., Open Court Publishing Co., Chicago and London, 1911)." It may be remembered that there was an article on Butler in *The Open Court* for August, 1913. The first part of an article by Philippe Sagnac deals with the origins of the French revolution. It was slowly born from the social and political regimen which Richelieu and Louis XIV established and Louis XV and Louis XVI maintained and aggravated. The prestige of royalty, of the church, and of the nobility had decreased, philosophy had helped to form public spirit, and the science of the time had helped to destroy the credit of the sacred books. A brilliant edifice, centuries old, was undermined, and there was the irresistible force of almost the whole of a suffering nation which was conscious of its rights. Charles Guignebert examines how the life of faith and the progress of theology strengthened and complicated the two primitive triads, eastern and western, in the dogma of the Trinity, and then how the inevitable conflict between the two conceptions came to pass. R. Maunier has a critical note on Egyptian art. There are general reviews by M. Gortani and G. Bourgin on the recent progress of geodynamics and the evolution of towns, respectively. Finally, there is the usual collection of reviews and notes and supplement.

* * *

The first article in *Scientia* for March, 1914, is by T. J. J. See on "The law of nature in celestial evolution." We have found, says the author, the fundamental law of sidereal evolution by first studying the most complex systems (the star-clusters), and, after making out the true secret of their formation, have generalized the law deduced from this study by the examination of sidereal systems of lower order. False premises misled Laplace, Sir John Herschel, Lord Kelvin, Newcomb, Sir George Darwin, and Poincaré; while the true path had been opened by Sir William Herschel, the first modern astronomer to give serious thought to the origin of clusters, in a series of papers published in the *Philosophical Transactions* from 1784 to 1818, and now accessible in Herschel's

Collected Works (London, 1912). The neglect of Herschel's conceptions of cosmogony was due to the greater accessibility of Laplace's writings. The modern "capture theory" of stars under the clustering power of universal gravitation (See), and consequent development of sidereal systems is essentially an extension of the views of Herschel. The process of capture also leads to the arrangement of the internal structure of a nebula in concentric shells of uniform brightness. The light of the nebulas is due chiefly to luminescence at low temperature, as by electric discharges in high vacua. There are many quotations from the papers of W. Herschel, and the other chief authorities in cosmogony are also briefly cited. The Herschel-See theory applies equally to sidereal systems of all types. "This quality of universality assures us the fundamental law of sidereal evolution, and alone makes possible the development of cosmogony as a new science of the stars, applicable, with unbroken continuity, to the entire sidereal universe." Camillo Acqua points out that, quite lately, phenomena of reaction in plants have been discovered, which are very perceptible and almost general for many agents of the outer world: a mechanism for receiving excitations, a transport of the excitation along plasmatic filaments of communication, which may represent physiologically—although they are not differentiated from the morphological point of view—the nervous fibers of animals. The reply to the question as to whether psychological phenomena exist in the case of plants "depends on the extension which may be given the psychological conception. The problem is proposed equally for plants and for lower animals which are situated at the end of the zoological scale. The hypothesis that even in these animals we must meet a psychological principle appears to be probable; but a decisive answer is not, and perhaps never will be, possible, since we would by such an answer penetrate into a part of that unknowable where the experimental method loses its efficacy and where the human mind had to confess its impotence." Emile Durkheim writes on the dualism of human nature and its social conditions; and maintains that it is only by historical analysis that we can give an account of how man was formed. The author's work on *Formes élémentaires de la vie réligieuse* (Paris, 1912) illustrates this general truth by an example. When seeking to study sociologically religious phenomena, the author was led to attempt to explain the particularities of our nature. The principle on which this explanation rests was not perceived by critics, and the present article is an exposition of it. S. Langdon

writes on "Babylonian magic," giving an abstract analysis of the principles and categories of Sumero-Babylonian magic; the article concludes with a few typical examples of both negative and positive magic chosen exclusively from the late period. Werner Sombart, in a study of love, luxury, and capitalism, does not propose to analyze the relations which exist between wealth, liberty of the amorous life, desire of certain groups of the population to be esteemed by others, and life in the large towns, on the one hand, and the appearance of luxury, on the other. Setting out from the fact that since the beginning of the middle ages a great luxury ruled, and attained great proportions towards the end of the eighteenth century, the author tries to find its explanation. The late F. W. Henkel gives a general review on the question of nebulas, and Arthur Kronfeld gives one on the new problems of psychiatry in Germany. Besides reviews of books and periodicals, etc., there is the usual supplement containing French translations of the English, German, and Italian articles. Φ

VOL. XXIV. OCTOBER, 1914 NO. 4

THE MONIST

BUDDHIST INFLUENCE IN THE GOSPELS.[1]

THERE are four cases in which after long consideration I have become convinced that Buddhist influence in the Gospel stories cannot be denied. This conviction in the first two cases is based essentially upon the latest exposition from Edmunds's pen.[2]

1. The Buddhist story of the *old saint Asita and his glorification of the child Buddha* has often been compared with the story of Simeon in the temple (Luke ii. 25f). It is found not only in the post-Christian biographies, in Ashvaghosha's Buddhacarita, in the Lalitavistara, in the Mahâvastu and in the Nidânakathâ, but also in the Suttanipâta, one of the oldest Pâli sources which takes us back several centuries before Christ's birth.[3] The saint Asita on a visit to heaven observes that the divine hosts are shouting for joy and learns from them that the Saviour of the world has just been born upon earth. Thereupon he hastens—in a miraculous manner, as Simeon to the temple—to the birthplace of the child, who shines with a brilliant splendor. He takes the child on his arm, calling it the highest and most glorious of mankind, but soon bursts into tears because he will have to die before the child will have attained Buddhahood.

[1] This article comprises pp. 47-61 of the first chapter of Dr. Garbe's *Indien und das Christentum* (Tübingen, J. C. B. Mohr, 1914. English translation by Lydia G. Robinson in preparation, to be published by The Open Court Publishing Co.)

[2] *The Monist*, XXII, 1912, pp. 129f.

[3] Accordingly it is quite impossible to find Christian influence in the Buddhist story as does Fausböll in *Ausgabe des Suttanipâta*, p. vi. Cf. also Oldenberg in the *Deutsche Rundschau* of January, 1910, p. 30 note.

In spite of some discrepancies the agreement of this story with the story of Simeon is greater than in most other cases; but it would not be sufficient by itself to render probable the dependence of the Christian upon the Buddhist story. It has been justly asserted that the fundamental idea, namely that an old man as representative of old times does homage to a child who is to introduce a new era, is to be explained on both sides from universal human experiences. Even Edmunds admits the weakness of the Asita-Simeon parallel if regarded by itself; "but its strength consists in its organic connection with the Angelic Hymn, both in Luke and the Sutta Nipâto."[4]

Here to be sure first of all a correction is necessary. The connection of the Asita-Simeon parallel with the glorifying of the heavenly hosts is not "organic" on both sides, but only in the Pâli text; whereas in Luke the story of Simeon does not stand in an intrinsic connection with the glorifying of the heavenly hosts (ii. 9-14) but only in its immediate neighborhood separated by seven verses. But even this coincidence is so remarkable that we can not think of it as accidental. Moreover in the Buddhist source Asita's knowledge of the birth of the miraculous child which he learned through the rejoicing of the heavenly hosts is much better accounted for than that of Simeon in Luke.

The text of the heavenly rejoicing in the Suttanipâta (in Edmunds's translation) is as follows: "The *heavenly hosts* rejoicing, delighted, and Sakko the leader, and *angels* white-stoled seizing their robes, and *praising* exceedingly, did Asito the hermit see in noonday rest. [He asks the angels why they rejoice, and they answer:] The *Buddha-*

[4] *Op. cit.*, p. 131. Pischel in his *Leben und Lehre des Buddha* (2d ed., p. 18) regards a loan on the Christian side as very probable without taking this connection into consideration; and even Winternitz, who thinks very little of loan hypotheses ordinarily, declares the Asita-Simeon parallel in itself "one of the most striking Buddhist parallels to the Gospels" (*Gesch. d. ind. Litt.*, II, 1, p. 75, note 2), and regards it as (p. 281) "to some extent probable that the Buddhist legend was known to the author of the Christian story."

to-be, the best and matchless Jewel, *is born for weal and welfare in the world of men,*[5] *in the town of the* Sâkyas, in the region of Lumbinî. Therefore are we joyful and *exceedingly glad.*" Thereupon Asita hastens to do homage to the new-born saviour, as do the shepherds in Luke.

It is impossible to expect a closer coincidence of the Buddhist legend with Luke ii. 9-32 under the previously established hypothesis that the former traveled by oral communication from Bactria into Syria. We ought rather be surprised that so many characteristic features of the Buddhist original have been preserved in the Christian recasting.

2. The *story of the temptation* belongs to the most striking and the most generally discussed parallels between Buddhist literature and the Gospels; for an incarnate devil is not made to appear on earth in any other place in the Bible, but constantly in the Buddhist canon. According to the narrative in Matt. iv. 1f, and Luke iv. 1f, after Christ has fasted for forty days in the wilderness and is overcome by hunger, the devil demands that he change stones into bread, that he throw himself down from the pinnacle of the temple and worship him, the devil, in order to receive as reward in return the kingdoms of the world and their glory. Since all the temptations are in vain the devil withdraws ἄχρι καιροῦ, "for a season," Luke iv. 13. (Luther translates, *"bis zu einer günstigeren Gelegenheit."*).

Buddhist literature is extraordinarily rich in similar tales in which Buddha is tempted or injured by Satan (Mâra), now in one way and now in another. But for our purpose there are only three passages to consider from the earliest Pâli literature (the Padhâna-sutta, the Samyutta-nikâya and the Mahâ-parinibbâna-sutta), and these in a surprising way form a counterpart to the Christian temptation story and invalidate the reasons which have

[5] It is an unfortunate idea of Edmunds to explain the words in Luke ii. 14, *ἐπὶ γῆς εἰρήνη ἐν ἀνθρώποις εὐδοκία* as a literal translation of the Pâli text, *manussa-loke hita-sukhatâya jâto.*

previously been brought forward against the loan hypothesis.

The negative standpoint is best presented by E. Windisch with his usual clearness.[6] But that his expositions nevertheless leave room for the opposite conception has been emphasized by Van den Bergh[7] who closes his chapter on the story of the temptation with the following words: "The striking coincidences. . . . : the temptation in solitude by the devil who appears personally (Mâra) and speaks with Buddha, following close upon the hunger caused by a long fast;[8] the triumphant rejection of this temptation, whereupon the Evil One decides to await a more favorable season; the offer of the dominion of the world which is intended to keep the king's son from his higher calling. These are exactly the points which are already present in the ancient pre-Christian form of the Mâra story." Shortly before (pages 45-46), Van den Bergh had refuted the view that the corresponding legend of Parsism, which is nearer to primitive Christianity both geographically and dogmatically, and according to which (in Vendîdâd 19) the evil spirit tries to entice Zarathustra to worship him by the alleged offer of world dominion, offers a better point of comparison for the Christian story of the temptation. He believed that the parallel features among Christians and Zarathustrians appeared in much more diverse surroundings, whereas in the whole scheme of the Buddhist and Christian temptation stories there was more agreement; also that the Vendîdâd text does not deal with the dominion of the world but with the good fortune of Vadha-

[6] *Mara und Buddha,* Leipsic, 1895, pp. 214f.

[7] 2d ed., pp. 47-48.

[8] It is related in the Padhâna-sutta that Buddha in his exaggerated ascetic practices, of whose futility he later became convinced, had fasted almost to the point of death *before* the enlightenment, and therefore *before* the temptation which is of interest to us for our comparison and which took place directly after the enlightenment. Accordingly the fast serves the same purpose in the Buddhist as in the Christian legend, namely to account for the complete physical exhaustion of the Saviour as the point of attack for the tempter.

ghana, the reigning prince, which is held out to Zarathustra as a reward for forswearing the Mazda faith. I would like to add that in my opinion the dependence of the Zarathustra story on the Buddhist temptation story is not at all improbable. At any rate there are no chronological difficulties in the way of this hypothesis.

In the Avesta the evil spirit bears the epithet *mairya*, "destructive," which comes from the same root and is almost the same word as the Buddhist *Mâra*. But here we have one of the cases in which what seems probable at first glance is not correct; the two words *mairya* and *Mâra* stand in an etymological connection, it is true, but not in a historical connection. In the Avesta all evil beings are called *mairya*; and if one could suppose that this epithet is transferred to them from their commander yet the age of the Avesta writings in which it appears is at least in part removed beyond the suspicion of Buddhist influence.

To the words of Van den Bergh above quoted about the "striking coincidences" between the Buddhist and Christian legends Wecker[9] adds the question: "But where is the 'old pre-Christian' form of the Mâra story to be found which contains all these points or even most of them? There is no such story." To this it may be answered that there is indeed such a version, although it does not appear so distinctly in Van den Bergh's summary of the literature as in the combinations of passages from ancient Pâli literature recently submitted by Edmunds. This combination even furnishes two other striking coincidences and through these has mainly contributed to alter my standpoint on the loan question. That the ancient pre-Christian form of the Mâra story which corresponds to the Christian legend must be gathered together from different texts, need cause no hesitation, if we explain the influence on the Gospels

[9] *Christus und Buddha*, 3d ed., p. 21.

by the transmission of Buddhist tales from mouth to mouth and not by the utilization of a literary source.

The text of the passages which Edmunds places side by side with the text from Luke iv, is too copious for me to reproduce it here *in extenso*. Whoever would like to compare it entire must look it up in *The Monist,* XX, pp. 131-133. I limit myself here to what is essential for our purpose and observe in the first place that Edmunds's placing the passages side by side must be supplemented at the start by the account in the Padhâna-sutta[10] of the fast which Buddha had carried to the extreme limit. Only after this ought the story in the Samyutta-nikâya (Mâra-Samyutta, 2, 10) follow—the story of the temptation to assume worldly dominion and to change a substance—which I can not reproduce more tersely than in the words of Oldenberg:[11] "At one time the Exalted One was living in the land of Kosala, in the Himalaya, in a log hut. When the Exalted One was thus living retired in solitude this thought entered his mind: 'It is possible really to rule as a king in righteousness without killing or causing to be killed, without practising oppression or permitting oppression to be practised, without suffering pain or inflicting pain on another.' Then Mâra, the Evil One, perceived in his mind the thought which had arisen in the mind of the Exalted One, and he approached the Exalted One and spake thus: 'May the Exalted One, O Sire, be pleased to rule as a king; may the Perfect One be pleased to rule as a king in righteousness without killing or causing to be killed, without practising oppression or permitting oppression to be practised, without suffering pain or inflicting pain on another.' Buddha challenges him: 'What dost thou see in me, thou evil one, that thou speakest thus to me?' Mâra says: 'The

[10] Translated by Fausböll, SBE, X, pp. 69f, and better by Windisch in *Mara und Buddha,* pp. 9f.

[11] *Buddha,* 6th ed., pp. 356f; English translaton by William Hoey, London, Williams and Norgate, 1882, p. 312. The text has been translated in full into German by Windisch, *op. cit.,* pp. 107f.

Exalted One, O Sire, had made the fourfold miraculous power his own. If the Exalted One, O Sire, desired, he could ordain that the Himalaya, the king of mountains, should become gold, and it would turn to gold.' Buddha motions him away. What would it profit the wise man if he possessed even a mountain of silver or of gold? He who has comprehended sorrow, whence it springs, how can he bend himself to desire?....Then Mâra the Evil One said, 'The Exalted One knows me, the Perfect One knows me,' and disconcerted and disheartened he rose and went away."

Here Edmunds joins the story of the "Temptation to commit suicide" from the Mahâ-parinibbâna-sutta.[12] When Buddha attained enlightenment at Uruvelâ on the bank of the brook Nerañjarâ under the tree of knowledge, and had exterminated all earthly desire within himself, he had finally escaped Mâra's power. The Evil One was well aware of this; but he still cherished the hope that he might retain the rest of mankind in his fetters, and therefore sought to prevail upon Buddha to abandon the idea of proclaiming the truth he had obtained and to depart at once from this life. He came to him and said, "May the Exalted One, O Sire, enter now into Nirvâna; may the Perfect One now be pleased to expire. Now is the time, O Sire, for the Nirvâna of the Exalted One." But Buddha repulsed the temptation and declared that he would not put an end to his life, until he had obtained enough disciples, monks, nuns, lay brothers and sisters, to assure the continuance of his doctrine and of holy conduct.

[12] In two passages of this work which "resembles our Gospels more than any other text of the Tipitaka" (Winternitz, *Gesch. d. ind. Litt.*, II. 1, p. 31; Oldenberg, *Die Literatur des Alten Indien*, p. 94), namely II, 7-9, and III, 34-35, Mâra made the appeal to Buddha to enter into Nirvâna: once directly after the enlightenment, the second time three months before Buddha's death. Only the first temptation of this character has really any meaning, the second is a foolish repetition; but in our text the second stands in the first passage and refers to the earlier temptation of which Buddha tells his favorite disciple Ananda in the later passage. Edmunds has incomprehensibly inserted the first

From piecing together these passages in the text we have the following coincidences besides those established by Van den Bergh and cited above (page 484). Both in the ancient Buddhist legend and in the corresponding Christian account Satan attempts to lead the redeemer astray (1) to change one substance into another by the use of witchcraft and (2) to put an end to his life.[13] Thus we have in all too many coincidences to be satisfied with Oldenberg's explanation that in both cases the same obvious motives have given rise to the corresponding narratives.[14]

As far as the temptation to change, respectively, stones into bread and the Himalaya into gold is concerned, the Christian version of course represents the incomparably more natural supposition because of the situation. If the Gospels were as old as the Buddhist source we would not hesitate a moment to declare the Christian version the original one and the Buddhist a distorted copy. But since the Buddhist source is centuries older, if we are convinced of the dependence of the Christian temptation story upon Buddhist prototypes, we must accommodate ourselves willy nilly to the view that the genuinely Indian grotesque and exaggerated idea was constructed more simply and more naturally on Christian ground, and adjusted to the situation.

3. To Peter's *walking on the water* (Matt. xiv. 25f) we have a parallel[15] in the introduction to Jâtaka 190, where the similarity is far greater than usual. There we

passage of the text, which of course should be replaced by the second, whose substance I here give in brief, so far as it treats of the earlier temptation.

[13] Edmunds, *ob. cit.*, p. 133.

[14] *Buddha,* 6th ed., note 2.

[15] The first forgotten discoverer of this parallel was H. Wenzel in "Coincidences in Buddhist Literature and the Gospels," *Academy,* Jan. 12, 1889, p. 27. The same was pointed out later by Max Müller in the article "Coincidences" in *Last Essays,* I, p. 284f. (Reprint of a lecture of the year 1896. See *Fortnightly Review,* N. S., LX, p. 48f.) and independently of him also by Van den Bergh in *Indische Einflüsse,* 2d ed., p. 52, since the Dutch original of this book appeared in the same year (1901) as Max Müller's *Last Essays.*

are told of a disciple who wished to go to Buddha one evening and failed on his way to find the ferry boat by the bank of the river Aciravatî. Trusting implicitly in Buddha he stepped upon the water and walked on it as on solid ground as far as the middle of the river. There he awoke out of the joyful thoughts on Buddha in which he had been engrossed, observed the waves with terror and his feet began to sink. But he forced himself to a renewed contemplation and by its power succeeded in gaining the other shore and his Master.

In comparing this Buddhist story with the Christian, the corresponding feature that Peter began to sink as a consequence of his little faith just as Buddha's disciple did because of his wavering contemplation, is much more important than the theme of walking on the water. It seems impossible to account for this most remarkable coincidence in any other way than by a loan. And here it is only on the Christian side that a loan can be considered, although the Buddhist story is not in the Jâtaka itself but in the introduction to it and hence belongs to the so-called "Stories of the Present" whose composition brings us down to the fifth century A. D. But these "Stories of the Present" come from the same author as the "Stories of Other Births," i. e., as the prose commentary to the ancient Pâli verses; and the kernel of the Jâtaka prose is considered by the most eminent critics as far as the subject-matter is concerned to be in general as old as the verses.[16]

The idea that men can walk on the water by virtue of the power of their asceticism, or on account of their virtue or piety, is very old and wide spread in India, and it is entirely foreign to Judaism. If walking on the water has become a favorite theme in later Christian legends, it is on account of Peter's walking on the water.

[16] Oldenberg, *Nachr. d. K. Ges. d. Wiss. zu Göttingen*, 1912, p. 212; Jarl Charpentier, *Zeitschr. der Deutschen Morgenländischen Gesellschaft*, LXVI, pp. 41-42, note; Winternitz, *Gesch. d. ind. Litt.*, II, 1, p. 95.

Edmunds[17] finds the earliest record of this idea in Indian literature in Sûtra 6 of the Majjhima-nikâya, one of the oldest Pâli works. There Buddha names the ability to walk on the water as one of the powers of a pious monk. It is also frequently related in the sources that Buddha himself walked or flew over the water. The idea that extraordinary people were able to walk or drive in a vehicle on the water, however, belongs not only to the India of Buddhism but also to that of Brahmanism. In the Mahâbhârata the same thing is told of the pious and virtuous kings Dilîpa (VII, 2267, 8) and Prithu Vainya (VII, 2402).[18]

Edv. Lehmann, who otherwise does not believe in New Testament borrowings from Buddhism, says with reference to the parallel here discussed:[19] "If one were to assume a loan here perhaps it would not be a false conclusion; Christianity does not become any poorer by forfeiting this story." Certainly not; on the contrary! What sincere worshiper of Christ would not be glad to miss from the accounts of his life this and certain other useless sorceries which corresponded to the taste of those ancient times! I am thinking of the changing of water into wine at the marriage in Cana (John ii. 1f); of the coin that Peter

[17] *The Monist,* XXII, pp. 134-135. R. Otto Franke was good enough to give me the exact quotation in the edition of the Majjhima-nikâya by V. Trenkner and R. Chalmers (Pali text society). There it reads (I, p. 34, l. 16f): "When the monk wishes, 'I would like to be able to practice the various powers of holiness, namely to change from my one person into a multiplicity, from a multiplicity back into unity, to make myself visible or invisible, to pass unhindered through walls, rocks and mountains as through empty space, to dive into the earth as into water and out again, and *to walk upon the water as upon the earth without it yielding*'.... then he may become perfect in moral discipline...." Franke makes the following comment: "The passage is not unique, but occurs frequently in the Majjhima-nikâya and is older than the M.; for this scheme of the *iddhividhâ* (all the miraculous powers collected together) belongs to the plan of salvation which forms the kernel and foundation of the whole Dîgha-nikâya, the oldest (at least prose) text of the canon. We find it in Dîgh. II, 87 and correspondingly in all the following D.-Suttas up to XIII." See also Franke's essay, "Das einheitliche Thema des Dîghanikâya," *Wiener Zeitschrift für die Kunde des Morgenlandes,* XXVII, pp. 198f, 276f.

[18] E. Washburn Hopkins in *Proceedings of the American Philosophical Society,* XLIX, No. 194, 1910, p. 38.

[19] *Der Buddhismus,* p. 88.

was said to have found in the mouth of a fish which had first to be caught for this particular purpose (Matt. xvii. 27); of the cursing of the fig-tree so that it withered, because it bore no fruit at a time when there could not be any figs (Matt. xxi. 19f; Mark xi. 13, 20, 21); of the ugly expulsion of demons into the herd of swine that rushed into the sea and were drowned (Matt. viii. 30f; Mark v. 11f; Luke viii. 32f) and other similar instances.

4. The *miracle of the loaves* (Matt. xiv. 15f; Mark vi. 35f; Luke ix. 13f) has a parallel Van den Bergh does not mention but which I am compelled to count among the striking ones. In the Introduction to Jâtaka 78,[20] it is related that Buddha fed first his five hundred disciples and then all the inmates of a cloister with one loaf which was put in his begging bowl, and that nevertheless a great deal of bread was left over which was thrown into a hole by the gateway. Here too the similarity to the New Testament story is less noteworthy on account of the miracle as such but much more so on account of the feature that here too twelve baskets of fragments *were left over* and on account of the *repetition of the number five.* In the New Testament accounts, as we know, five thousand people were fed with five loaves (and two fishes). The smaller number five hundred in the Buddhist story has the advantage of originality in comparison to the five thousand in the New Testament. And it especially happens that "the number five hundred is eminently Buddhist, as we could prove by numerous texts."[21]

These reasons are sufficient in my estimation to look upon the Buddhist story as the source of the Christian

[20] Max Müller, *Last Essays,* I, pp. 284f; Franke, *Deutsche Lit. Ztg.,* 1901, 2760; Edmunds, *Buddhist and Christian Gospels,* 4th ed., II, pp. 253f. Max Müller has overlooked the fact that this parallel and the one discussed directly before it are not in the Jâtaka text itself, but in the later introduction to the Jâtaka.

[21] Edmunds, *op. cit.,* II, p. 256. R. Seydel has made the same observation in *Das Evangelium von Jesu,* p. 285, note 238, with reference to 1 Cor. xv. 6.

parallel, and at the same time to regard the material of the former as much older than its literary form in the "Story of the Present" of the fifth century A. D.

If we recognize Buddhist influence on the New Testament in these four cases[22]—and I think we must recognize it—we can hardly deny the probability that not only here but in other places in the Gospels the same influence has been at work where it has not shown the same degree of probability. Theology ought not to find any difficulty in making friends with this idea, for the eternal value of Christianity can suffer no injury from it.

Whoever admits the much stronger foreign influences on primitive Christianity on which I have dwelt in my Introduction[23] can also accept without danger to the Christian faith the harmless Buddhist influences on Gospel narratives. But it is very surprising that many theologians who are convinced of the deep-seated Hellenistic influences on the New Testament can not make up their minds to accept any influence on the part of Buddhism. Do they perhaps scent a greater danger?

RICHARD GARBE.

TÜBINGEN, GERMANY.

[22] Also the expression τροχὸς τῆς γενέσεως in James iii. 6, is, as Schopenhauer has already remarked, so specifically Buddhist and so generally Indian that it is difficult for me to account for it in any other way than by Indian derivation. The whole text of the verse sounds Buddhistic, for Buddha too compares the sense organs to flaming fire in one of his earliest speeches (Mahâvagga, I, 21, 2, 3: *jivhâ âdittâ*, "the tongue stands in the midst of flames," corresponds literally to the ἡ γλῶσσα πῦρ in our passage in the Epistle of James). That the τροχὸς τῆς γενέσεως is derived from the Orphic mysteries, as many theologians have thought (Clemen, *Religionsgesch. Erklärung d. Neuen Test.*, p. 58), is just as improbable as Edmunds's alleged Babylonian derivation (*Buddhist and Christian Gospels*, 4th ed., II, p. 263) following Count Goblet d'Alviella.

[23] Translated under the title "Gentile Elements in Christianity," in *The Monist*, July 1914, p. 454.

UNITY OF WORLD-CONCEPTION.

THOSE to whom philosophy makes no appeal, to whom metaphysic is anathema, and mysticism a mirage, turn hopefully to science as a guide to sensuous phenomena; and, in so far as the method of science is followed, no better aid can be found to explore the wonders of the world. Science, treading on the firm ground of experience and experiment, can travel far into the realm of nature, opening up at times new avenues of approach which even science hesitates to enter, and pursuing patiently her path towards some half-acknowledged and ever-receding goal of knowledge which the "man in the street" calls the "riddle of the universe." To speak of the arcana of nature as a riddle to be solved is, no doubt, to the humble student who brings his offerings to the temple of Isis, little short of blasphemous; but it is characteristic of the times to regard nothing as sacred and insoluble.

Now, the mariner who sails the high seas knows full well that to reach a known port in a distant land true orientation and correct charts are necessary adjuncts to his skill in navigation. Without these he could not attain his goal except at hazard and by hard adventure, and of these orientation is the chief essential. If he be navigating a sailing vessel across the trackless ocean, the general direction of his voyage will be towards his port of call; but many and devious may be the tacks against foul winds, away from the true direction of his objective, ere he sights his landfall. If finally, by consulting his chart, he decide that his goal may be reached by following

a definite course for a certain period of time, and he finds this indeed to be *true,* then it follows that all his previous positions pricked on the chart must have been correctly determined; and these positions are then made good. Science advances in this way.

This simple illustration, however, is applicable only to known ports and known routes; it cannot apply to the unknown. It follows on this analogy that any attempt to seek the unknown through the known processes and principles of the logic of science is a hazardous and speculative undertaking, since argument easily may be carried beyond the legitimate field of *verae causae.* Nevertheless, this is what many adventurers, trusting to a higher instinct, which sometimes inspires and sometimes misleads men, are trying to do at the present day. They follow confidently in the beaten path of science, in the hope that, eventually, they may outstrip her and win to the promised land. What that land shall contain for them is merely adumbrated by philosophers and men of science alike: if it were known, there would be no need to seek it except as a recapitulation of experience; being unknown, they await the dawn of another day, and yet another day, when, perhaps, this object of knowledge—dimly perceived—shall be fully determined.

But why, one may ask, should one postulate any such object of knowledge?

Should not we be content with things as we know—or think we know—them to be, rather than speculate on things as we would have them to be, since the former is the criterion of science? Is there any appeal to supersensuous phenomena? "The first and greatest question which philosophy has to resolve, in its attempt to make out a Kosmos," said Sir John Herschel in one of his *Popular Lectures* (p. 474), "is whether we can derive any light from our internal consciousness of thought, reason, power,

will, motive, design—or not: whether, that is to say, nature is or is not *more interpretable* by supposing these things (be they what they may) to have had, or to have, to do with its arrangements. Constituted as the human mind is, if nature be *not* interpretable through these conceptions, it is not interpretable at all." We know that migrant birds and certain aboriginal savages possess an innate power of orientation, and we account for this in a simple and natural way: by heredity, or adaptation to environment. We know, too, that man always has possessed in a greater or lesser degree an innate faculty of apprehension, which orients his mind towards something beyond himself in the direction of psychic experience and development. The world may satisfy his material needs—and does for most men, who find it a hard taskmaster—but in the realm of mind material needs are merely supporters of the intellect, as oxygen is a supporter of combustion. The trained mind —the intellect—ranges far beyond the common objects of thought and is nourished by ideas and ideals. There is, in short, in every healthy and simple mind, an innate sense of psychic function residual in consciousness, which men —certain idealists, at least—call the soul. To find a fitting habitation for the soul in the universe of mind and matter is the ideal quest of truth.

The restless spirit of modern thought, which courts disaster by the very excess of its energy, is held in check—no less than inspired—by the advance of science in search for a universal formula that shall interpret the significance of life and mind and correlate the forces of nature. Logically, such a formula is readily reached by appeal to the law of continuity, based perhaps on reciprocity of force—a logical extension of thought in a cosmos of recurring phenomena. But science is impatient of metaphysical speculation and builds its hypotheses on surer ground. It cannot altogether discard the metaphysic of

experience—as witnessed in the Newtonian laws of motion with their metaphysical groundwork—but it limits this indiscretion to the debatable borderland of mathematical proof. The groundwork of science is a closed system of thought; and, therefore, science never can usurp the primacy of thought, which transcends experience.

It is well for the advancement of science that this closed system of thought should be rigidly fenced and jealously guarded by constituted authority, lest speculation—as to what may lie beyond—lead to error and confusion. It is well, too, for the advancement of man that this closed system should not imprison thought within the iron bars of scientific materialism (epiphenomenalism) lest visions of freedom—for his insurgent soul—do but mock his highest aspirations, and so enslave his will to the exclusive exercise of his material functions.

In the realm of mind there are no barriers to freedom of thought; the attributes of mind are consentaneous with the established order of things. But no two men of deep and original thought see things precisely in the same order and as having the same value of mind; each will have his special connotation and his individual interpretation. Hence arise controversy and mutual misunderstanding. The great reconcilement between thought and things is, by common consent, adjourned to the Greek Kalends.

Nevertheless, the obvious unity of nature demands an interpretation of the cosmos in terms of finite mind, the exclusive heritage of man. A true system of thought should represent synthetic unity of world-conception and a monistic view of substance in correlated terms of mind.

Man is born to a godly heritage, the fruit of labor. Alone, among all forms of life on the earth, he enjoys this distinction, this dignity, this power: to labor towards some desired end, *consciously* and of set purpose; to create ideals of perfection and strive to attain these ever elusive goals.

He raises his home on the ashes of the past, which the wind scatters. He receives thoughout his life more than he ever can repay, and thereby enjoys a balance of benefit. Time passes, and he too falls from the ranks of men marching towards their destiny; but, in passing, the spirit of man is handed on and recast from generation to generation.

Change and decay follow in natural order; each change serves its purpose for a time and is cast aside like a useless garment. Each generation stands midway between the past and the future; each regulates the periodic equilibrium of progress in the subcontrary movement of thought. Nature has a way of equalizing matters, a veritable force in organic evolution. That which never changes, but becomes only more conscious of itself, is the spirit of man, which inspires all his actions. Hence arise awareness and knowledge of self.

The torch of knowledge is passed from hand to hand, and burns brightly or dimly in the handling of it; at times it is all but extinguished. To dwell in darkness is to live a stunted life devoid of color and beauty; to rekindle the torch is beyond the power of ignorance. The torch of knowledge is a sacred flame, and those who serve nobly in its temple enjoy a distinction beyond the recognition of princes; posterity acclaims them. Knowledge nourishes and advances thought. Like the sun, it sets all things in motion; it illumines all objects of perception; it brings forth fruit in good season.

Thought is the fruit of the mind. Beautiful thoughts live for ever and purge the mind of evil communings. Law and order are evolved from careful culture of the highest thought.

Out of the chaos of unrelated things (such as cows and cowslips), of ignorance, of blank mind, there arise here and there threads or filaments of knowledge which, on being carefully traced, are found to link up facts that bear

a family likeness to one another—facts which thereby are said to be correlated, the sum and synthesis of which is true knowledge. The nervous system of man, apart from his body, thus may be pictured. The animal, vegetable and mineral kingdoms are examples of this arrangement of ideas. The solid, liquid and gaseous character of substances are other useful generalizations for grouping together co-ordinated factors of knowledge.

Our outlook on the world, too, is greatly simplified and extended by regarding its main natural divisions apart and in their inter-relationship—the land, the sea, the air. These also may be called kingdoms.

There are kingdoms, then, of the earth and of mind. Once the order of a series of allied facts is perceived, it becomes possible to establish a law by which these can be explained and related to other groups of facts. By this means we recognize families of facts, or categories of thought, which can be isolated, or set apart, for the purpose of closer study; to confuse these, by mixing them together, is to lose all trace of logical consistency.

The highest minds of all time have been engaged in this fascinating pursuit. First warily, by means of hypotheses or assumptions—mere guesses, sometimes—to account for what is not clearly understood, these men of thought and leading have created out of the chaos of things, dimly perceived, a structure (or framework) of logical reasoning (or simple formulas) which links up and groups all like facts and principles; but, until the idea or spirit which explains or vitalizes the meaning and purpose of this structure is discovered, it remains a dead thing: it cannot live in the race-memory. Monuments of patient research such as these are not often built up; but, when successfully raised, they remain—for centuries, perhaps—landmarks in the maze of thought.

Now the ideas that explain and vitalize many things that happen on the land, in the sea, and in the air, can be indicated briefly by two pass-words which carry us very far into debatable kingdoms of thought. These are the idea of *evolution* and the idea of *circulation.*

The idea of evolution is mainly associated with development of structure, or form: the external aspect of anything. The idea of circulation is associated with the function of elements composing anything: the internal flux of things undergoing a change of state, which usually is in the direction of complexity and expansion; as a butterfly from a grub, a torrent from a cloudburst, a revolution from an ideal. In this natural sequence—seed, flower, fruit— we perceive a *continuity of idea* in the same plane of thought, by which we come to recognize general principles of growth and development. If natural phenomena —things that happen in the orderly course of nature—were not uniform and constant, we could not reason logically, and therefore would be unable to discover any laws; but we rely absolutely, and stake our lives daily, on the uniformity and constancy of natural phenomena, and so escape shipwreck at sea and many perils by land in our familiar intercourse with nature.

There is, on the whole, a progressive evolution of forms from simple to complex, from indefinite to definite, both in things that live and things that are inanimate; and generally it will be found that the change of state, or degree of modification, is from a lower to a higher form of structure and function—and by higher form we mean a state better adapted for survival or service in the purposes, or apparent ends, of nature. From this broad generalization we derive the useful aspects of our subject which are known as the *organic* and the *inorganic* realms of organization, in the building up of the world: things which live and pass on *life,* and things which change or modify their

material composition. Thus, the fundamental antithesis in nature is *mobility or motion* (life and movement) and *rigidity or inertia* (complexus of matter); and the interplay between these dual forces in nature enables us to formulate a physical basis for phenomena.

Nature knows no rest. There is a constant flux and whirl of particles in all movements of matter, an interchange of properties between the elements of substance. But with this molecular motion we need not concern ourselves, beyond noting the fact that—for science—it exists; it is enough for us to have grasped a working principle, universally applicable, which underlies the study of terrestrial phenomena and illustrates the countless phases of circulation.

Restless nature moves on the face of the waters, which leap towards the moon in its path and sway towards the sun, by which tides are caused. Restless nature draws up bountiful supplies of vapor, which condense in a cool atmosphere and flood the earth with life-giving properties; denude mountains and scour out valleys; loose everything like hounds from the leash, to run an appointed course. Gravity, density, temperature and pressure are the principal agencies through which the activities of nature are revealed to us—apart from growth and development: in the roar of the storm and in the sweet silence of the desert, in the circulation of air and ocean currents, in the transformation of all matter on the surface of the earth and in the mutation of living forms, passing through the familiar cycle of change and decay, life and death, movement and counter-movement.

This constant struggle to establish equilibrium between the interacting forces of nature is thus curiously shown to be paradoxical in the sense that equilibrium does exist everywhere and in everything; but with this qualification: it exists only for a moment of time in a potential state of

change. Like the see-saw of children, nature, poised on the fulcrum of motion—i. e., stability of motion—determines the sway, this way and that, of the counterpoised levers that constitute our children's plank. The fleeting moment of equilibrium—i. e., moment of momentum—is always on the point of being overcome by the forces of action and reaction; and in these fleeting moments we pass our individual lives. Time, then, in all spatial relations, is inseparably associated with the consentaneous action of symmetrical parts in any system: the longer the time, the greater the change in the evolutionary field.

Action, however, is of two kinds—determinate and indeterminate. An indefinite act is simply the continuity of some previous movement in the same direction, subject to some unforeseen check to its development or issue in the flux of things. A free act, on the other hand, may be defined as a movement, or the arrested development of a movement, directed towards or against some definite end or purpose. Nature—as we understand her—being intensely dualistic and teleological, thus offers a choice between order and chaos, chance and purpose, in our construction of a cosmos; and therein lie all the elements of confusion and controversy.

What we see in nature is what we, ourselves, posit. The so-called laws of nature are, in reality, the laws of man-made nature—of man's interpretation of natural phenomena: causes, sequences, and the like. Without some idea of these, we cannot truly grasp the inner meaning or structure of things, even of the simplest. Most of us, it is true, are content to take things as we find them, with the official label attached, and secrete them in our memory; but there are others, of a rebellious type of mind, in whom a divine discontent reigns—a rage for finding out *how* things are made and *why* they work, a reverence for nature, worship of beauty. To all such, nature appeals with irre-

sistible force. The world becomes a temple—the temple of Isis—not a dead museum, in which silence and contemplation, search and research, thought and study, are the proper attitudes of mind. To all such, life never can be devoid of interest, never can disappoint, *but never can satisfy,* because the pursuit of knowledge for itself lures them towards an ever-receding horizon beyond which truth dwells, forever beckoning.

* * *

The truth of everything that is true and the falsity of everything that is false are true and false, respectively, only in relation to prevalent criteria of knowledge. The movement and persistence of thought are as fluent as the flux of things. But although the critical value attached to the precise meaning of a given term may vary in time, the idea created in the mind by its spontaneous expression—i. e., mental presentation — has a tendency to persist. Thought, then, in its persistence, has the quality of momentum; and if in quantitative analysis a fixed ratio to the sum of things—a world-formula—be sought, it may be found to lie in certain general principles the root idea of which is self-evident and of universal application. Of such are the idea of gravitation and the idea of biogenesis (life from life). The precise terms in which at the present day these two problems of science may be stated are undergoing revision; but, whatever be the issue in detail, their qualitative significance as fundamental concepts of mind is not likely to be affected.

The ideal goal of knowledge can scarcely be reached, or even sighted, until physical science (cosmology) becomes more philosophical and catholic in its outlook on the objects of knowledge; and until philosophy, thus reinforced, adopts the method of science in examining the intimate nature of knowledge, in order to derive a uni-

versal (space) and fundamental (time) principle that may be expressed in the unity of a formula, or constant of function, in cosmogonic evolution. Some such controlling factor seems essential to a strictly monistic view of substance and in order to define the evolutionary process. This factor we take to represent, in principle, the coefficient of meaning, carried through all the operations of thought in their quantitative expression. Unity of idea must underlie and govern any rational system of organization; and this unity, in some form, must be capable of realization. For, if a thousand persons of diverse minds surrounded a perfectly conical hill, all might reach the summit, blindfold, by taking the line of greatest resistance. This guiding principle in nature we take to be *difference of potential,* in the macrocosm: *identity-in-difference,* in the microcosm.

Is such knowledge possible? All we can attempt, in this place, is to indicate a few directions in which this root principle may be traced.

Our philosophy of unity postulates universal law operating harmoniously and reciprocally in nature, based on the dynamics of force—as a mechanical conception—which is the motive-power of the cosmos.[1] The fundamental idea of force has not yet been fully stated by physicists. Force (they say), like energy, is a dual conception, involving not only that which generates, accelerates, or changes motion; but it involves also resistance. No force exists without resistance. Ultimately, all things resolve themselves into two incomprehensible factors, and their duality is reconciled by a mysterious underlying unity which transcends our conception—or, at least, experience—both in living and non-living matter: the persistence of energy and the

[1] In general terms, force (or, at least, virtual force) may be defined as the ratio (MV^2) of mass and velocity in time and the constant of motion in space. In all apparent interactions between force and substance, the product (or sum) of the potential (or existing) energies remains unchanged. We therefore regard force and substance as two aspects of one and the same principle: conservation of work.

resistance of inert matter are essential to the existence of things, in the promulgation of science. Matter (in our view) is the vehicle of energy—its objective reality; and both are attributes of force, by virtue of which things are as they are—a self-compensating unity. Eliminate stability of motion, which binds atoms and molecules together in temporary groupings, *pari passu,* and the world would be pulverized into integral particles, each of which would be an electrostatic nucleus of energy. Destroy, other than to convert into energy, an appreciable aggregation of matter, and the cosmos would collapse—that is, the cosmos of science.[2] The mere fact of stability denotes static equilibrium, any subsequent disintegrations or mutations being in respect of time only. The conservation of energy and of matter are fundamentally essential to unity of world-conception. In how far may that unity be further expressed?

The lithosphere, or crust of rocks, and the hydrosphere, or system of oceanic waters, compose the planet earth, which in its orbit round the sun carries an atmosphere in its flight through space. The ether of space, which the unification of physics compels us to postulate, is the medium that transmits light and heat throughout the universe, and probably also is the seat of all electrical and kinetic forces. It even may be conceived as the immediate origin (or substratum) of all life and movement on the earth. The thousand millon stars and planets which we calculate to be in constant orbital motion float in this ethersphere, as jelly-fish in the ocean, and are composed of its primordial

[2] Thus, according to Newtonian principles: if the earth were to be blown into ten thousand fragments *at this instant,* every particle would return (or persist in a tendency to return) at some time or another to the point in space (relative to the solar system) which we occupy *at this instant.* Similarly, if an object be ejected at any time, it will describe an orbit which must pass through (or persist in a tendency to pass through, unless acted upon by some external force) the point in space (relative to the solar system) from which the expulsion occurred. This we take to denote reciprocity of force (by which a dynamical theory of motion is demonstrable) in mechanical causality: in other words, the mechanism of gravity, by which conservation of momentum is maintained.

world-stuff—i. e., modifications of ether. Thus, it may be inferred, electronic or corpuscular substance, interpenetrating all modes of matter, is the common basis or constituent of matter, the *Urstoff* in the laboratory of nature. The visible universe of matter contained in it is scarcely appreciable, in comparison with its immeasurable immensity. Nevertheless, the principles underlying the subtlest processes of nature are symmetrical, both in the infinitesimal and in the illimitable, in the atom and in the sidereal system; and this may be assumed, failing evidence to the contrary, in a system of thought proceeding from the known to the unknown by logical inference.

A molecular theory of matter, if less demonstrable than a molecular theory of electricity, is foreshadowed in the researches of Thomson, Larmor, and Lorentz. "For the most natural view to take, as a provisional hypothesis," says Sir J. J. Thomson,[3] "is that matter is just a collection of positive and negative units of electricity, and the forces which hold atoms and molecules together, the properties which differentiate one kind of matter from another, all have their origin in the electrical forces exerted by positive and negative units of electricity, grouped together in different ways in the atoms of the different elements." This amounts to an electro-magnetic theory of matter, of electrical forces between material particles. A system that admits of quantitative statement and analysis is essential to a working hypothesis. In a qualitative sense, too, if the energy of affinity, which individualizes substances, be the kinetic grouping of the elements of bodies, foci of force and centers or nuclei of condensation bear a dynamic relationship in some conceptual scale of classification, which may be called an isochrestic scale.

[3] Presidential Address: British Association, 1909. His electrical methods of experimenting tend to confirm the view that every atom (like the ultimate organic cell of the biologist) consists of an inner core or nucleus of definite significance and an outer husk of indefinite organization.

Furthermore, in the same address, Sir J. J. Thomson made the following illuminating pronouncement. "If," he said, "we regard potential energy as the kinetic energy of portions of the ether attached to the system, then all energy is kinetic energy, due to the motions of matter or of portions of ether attached to the matter....and that the potential energy of the visible universe may in reality be the kinetic energy of an invisible one connected up with it. We naturally suppose that this invisible universe is the luminiferous ether, that portions of the ether in rapid motion are connected with the visible systems, and that their kinetic energy is the potential energy of the systems."

In other words, we presume, if the ethersphere be the dynamic plenum of substance and the substratum of matter, all motion is primarily ether-motion, and all mass is essentially ether-mass, fundamentally and phenomenally: indeed, it must be the *primum mobile* of the forces of nature. The specks of matter called worlds, immersed in the maelstrom of this mighty mobile force, in silent strife of motion, and correlated streams and drifts (witness, the stars) of motion, are as jelly-fish in the ocean of space, and can no more set up independent motions of translation in respect of cosmic environment than submerged bodies in terrestrial ocean-drifts. Thus: the apparent mechanism of the universe may be likened to a seething whirlpool of interrelated currents and eddies of gyroscopic motion (or moving masses of equilibria) in which collocations of substance and aggregations of matter, at every stage of combination and in every degree of cohesion, move and have their being. And all this takes place simply by energy of relative position (i. e., difference of potential) spontaneously working on inertia of mass, until equilibrium is established, *pari passu,* within the system (i. e., equilibrium of forces between pairs of opposite sign).

This monistic world-conception may be developed into

a dynamical theory of motion—a world of moving forces, and not a world *at rest*—by assuming stability of motion to connote the moment of momentum (or static equilibrium) of a system, and to correspond with reciprocity of force in mechanical philosophy. To the dynamic mind, motion that ceases to be mobile, in the routine of cosmic phenomena, becomes mass (the product of correlated motions); and energy that ceases to be active—i. e., kinetic—becomes potential energy, available power, or force. All mass movements, as well as intermolecular action and reaction, may be expressed in terms of energy, power, or force, each of which in its ultimate expression may be held to comprise a synthesis of syntheses of motion; and unity of world-conception may be readily reached by regarding motion as the circulation of energy-systems in the ether of space, arising from difference of potential (expressed in ratios of equilibria) and giving rise, as in electricity, to associated phenomena. Thus, it seems reasonable to infer, from these generalizations, the existence of an underlying principle—the prime integral of all evolutionary processes—which, if not force, or the persistence of force, at least involves the conservation of energy. We throw out this crude suggestion as an embryo formula: That the negative instability of any system whatsoever is controlled by a positive stability of type, or *persistence of ideal configurations,* in cosmical evolution; and that all modes of matter in organic affinity are determined by typical groupings of positive and negative units of "electricity," or aggregates of particles, in specific association with homogeneous elements and heterogeneous compounds, or aggregations of mass, in the evolution of corpuscular substance. Density and mass are the watchwords of life and movement, and order of mass is the order of evolution. Thus, identity-in-difference in the microcosm may be held to connote difference of potential in the macrocosm.

Mr. F. Soddy, discussing the evolution of the elements, says: "The energy changes accompanying any form of continuous material evolution must be the controlling factor of any cosmical scheme, and the failure to recognize this so deeply affects all the existing views on cosmical and terrestrial evolution that it is difficult to see what will remain when it is rectified."—(*British Association Report*, 1906.) The trouble with schoolmen is that they cannot, or will not, think in categories of thought other than those in which they have been trained. To them, the mere attempt were like writing with the left hand.[4] Experimental science, not being able to simulate nature, necessarily has recourse to conventional methods of demonstration—methods, no doubt, that yield true results in quantitative analysis. Categories that are rigidly segregated in the lecture room are, however, intimately associated in natural processes, and these are the only real categories of genetic logic. In order to demonstrate the evolutionary movement—which of necessity must be continuous, whether we perceive the continuity or do not—the intellect must bridge the gap between the organic and inorganic realms of organization by postulating a constant of function in the universe of substance inseparably associated with a logical extension of principle in the realm of mind. Is such an aid to clear and consecutive thinking to be discovered in *verae causae*? Our thoughts, based on the significs of science and rigidly controlled by logical method, must range through the debating grounds of psychology, psychophysics, and metaphysics, to a new category of thought expressed in terms of energetics. We may then discover

[4] The Newtonian laws of motion, for instance, cannot be taken as representing absolute truth. In infinite space, and without a frame of reference, a body cannot be said to be at rest or in motion—far less, motion in a straight line. A frame of reference is essential. These laws are merely projections of our perceptual experience. If our perceptions were different—as, indeed, they are in the dynamic mind—the laws would be differently expressed. Identity-in-difference reconciles the duality.

a universal calculus, or constant of function, applicable to all forms or modes of motion. In fine, a high order of mind might derive a higher—i. e., more extended and complex—synthesis. "May we not say," remarks George Henry Lewes, "that every special form of existence, organic or inorganic, is determined by the synthesis of its elements?" That being so, a synthesis of syntheses of syntheses may be reached.

All thinking is relative. Our thoughts must have some background or framework, our mind some standard of value, before we can identify and classify any object of knowledge. To name a thing is not to create it, but to identify it; and this is the task of science. Consequently, nomenclature plays an intrinsic part in the discussion of phenomena. It is the *identity-in-difference* that characterizes objects of knowledge, rather than their abstract qualities apart from a frame of reference. Abstract and concrete ideas of things arise from introspective and extrospective analysis; and no mind can form a true synthesis of any apparent unity without complete knowledge of its constituent parts or elements. When such knowledge is incomplete, the synthesis that presumes to be called a law of nature is no more valid than any other hypothesis by which the pathway to reality may be profitably explored. Thus, all the so-called laws of nature simply represent for us a universal consensus of expert opinion, an economy of thought, a shorthand method of standardization to facilitate further inquiry. They are true, but only relatively to existing criteria and forms of knowledge. Nature knows no law, as apprehended by our anthropomorphic thought, but the law of being: *Whatever is, is,* which is the fundamental law of thought. We must take things *as given,* and try to understand them. We must think cosmically and humbly.

The advance of knowledge waits on the discovery of

mechanical media or experimental research to stimulate or augment our sense-perceptions; and mental presentations rest, in the meantime, on rational hypotheses that co-ordinate and interpret the empirical dogmas of science. Scientific faith and imagination are essential handmaids to discovery. Scientific instinct is the herald of exact knowledge. There is nothing new under the sun save in our perception of it, when it is added to the common pabulum. It is in the analogies, the correspondencies, and the homologies of nature—dangerous as these are as guides—that the man of science, by his laboratory experiments and tests, seeks for new light on old problems. Thus, the secret of electricity, which may determine our knowledge of the structure of matter and much else besides, is now being unraveled in the vacuum tube. The atom (revised version) is the philosopher's stone, which, peradventure, may carry us a little further than Plato and Aristotle.

The mere fact that coordination of phenomena and synthesis of noumena are sought in all departments of earth-lore in relation to the cosmos indicates the demand of reason for causality, since the laws of thought and the laws of motion are intimately associated in function. Unless nature[5] thought (i. e., functioned) consecutively, logically, and inevitably, it would be impossible for the man of science to formulate any rational hypothesis. But since sense-impressions and secret cosmic processes may be incongruent, or even incompatible, allies, we fall back on real logic, as being the surest path to essential truth, intuitively apprehended as such. Logical inference (no less than mathematical formulas) is an economy of thought, the shorthand of mind—that is, the trained mind or intellect, which reflects, however dimly and inscrutably, the

[5] Nature, regarded as cosmic process, is scarcely to be distinguished from the Absolute of philosophers, but is more anthropomorphic in form, and to that extent better fitted to express the whole of conceptual analysis, in cosmic function. The Absolute is revealed in the unity of nature.

mind and meaning of the cosmos. Sharper definition of focus resolves the nebulous haze that screens cosmic phenomena. If there be persistence and equivalence of mass, there must be also persistence and equivalence in the mechanical value of energy—*free* energy, determining all phenomena—in a quantitative sense, the change in consistency or valency yielding a qualitative process of evolution; and therefore it were illogical to limit evolution to ponderable substance. The visible universe is finite, simply tending to aggregation of mass; the invisible universe underlies all phenomena, of which it is the nervous system—so to speak.

Science performs a useful function in the standardization of thought, of sense-data; but it never can usurp the prerogative of mind to pronounce final judgments, nor does it advance such a claim. Science is method—a means, not an end. The most advanced thought of the day is, we may infer, endeavoring to bridge the abyss between the organic and the inorganic realms of organization — an abyss in our *knowledge* only, since evolution must deny itself if it admit discontinuity of its processes. By a secret process of integration, nature *informs* matter, and her purpose is thus satisfied, by specific molecular association of individualized substances. "The true cosmic line," says R. B. Arnold,[6] "in the matter of individuation, is—the electron, corpuscle, atom, molecule; then, perhaps, the physiological unit in the vital organism, and finally the mental being." This line of attack is reinforced by Mendelian method, which is the idea of a living organism as built up of numerous unit-characters represented in the germ-cell by definite factors. Such a scheme were capable of quantitative, as well as qualitative, analysis; i. e., constant ratio of quantity, as well as constancy of association, in nature's laboratory. Hence, in the phenomena of life

[6] *Scientific Fact and Metaphysical Reality*, pp. 104-5.

and mind, ratios of disparities—if such can be measured —would determine, by difference of potentiality in related categories, the movement of thought—i. e., development of idea—in substance. The persistence of psychic life thus may be traced, from its genesis in self-consciousness—"I am" — to its penultimate issue, in the realm of mind. Whether thought can be carried further than organized inclusive experience—i. e., mind—is the "riddle of the universe," as we understand it. That depends on experience; and the world is still young. "Men should work, as if they were to live for ever; and live, as if they had to die to morrow." The work is everything, the man is nothing—to posterity.

Finally, our concepts of time and space in terms of formal thought may be delivered thus: Time and space may be defined as sense-intuition of that which is internal and external, respectively, to mind, while as a composite reality and essential unity these prime concepts, in our consciousness of being, are phenomenal (*qua* sense-intuition) in the inherent condition of any connotative or genetic relationship. In all interactions between time and space, the ratio of relativity remains unaltered. All depends upon the point of view, and until this fundamental principle in cosmic evolution is grasped and applied, professors of your Know-not-what school will vex their souls, and their students, in vain. Thus, ether may be continuous as regards matter and discontinuous as regards substance (in the degradation of energy) without losing its essential character of continuity in substance, any change of relative consistency, or valency, being due to difference of potential, as in the flow of electricity from one body to another. The ether must, in fact, be cleavable—though continuous in respect of "gross" matter—in the sense that water and air admit of differential movements of equilibria. Given an ether of the density claimed for it, we can cenceptualize

a cosmos *congruous with known truths.* The ether of space, in which the warfare of worlds is waged with as little commotion to its mass as from the dropping of a pebble into the sea, which bears the stress of the universe of matter as easily as a radiogram from America to Europe, contains for us, it may be, the arcana of nature. It is the last unexplored region in the realm of mind which man may aspire to reach. It is a fruitful field for the philosopher of nature, in which the psychologist may find his *psyche* and the biologist his *life.*

We argue in this way. If, as a necessity (or even as a postulate) of reason, a missing article (or connecting link) *must be* located in one of twelve places, and we ransack eleven of these places without finding it, then *it must be* in the twelfth place, even, though that place be beyond our reach and therefore excluded from actual investigation. This conviction of mind produces faith in the understanding. We adopt the view of Mr. Balfour, that as natural science grows it leans more, not less, upon an idealistic interpretation of the universe." The conservation of thought-values is the sole objective of truth. The known and the unknown, the natural and the supernatural, are correlated terms. They complement one another, in the ratio that decrease of the one demands increase of the other: the momentum of truth. Intellectual life is a great conversation, having for one of its objects the elucidation of phenomena. Progress is like a swallow's flight—a dip and flow along the mean level of current thought.

If a complete synthesis or sequence of cosmic phenomena could be thrown on a screen by cinema-process, the various phases of evolution would blend into a perfect unity and function harmoniously; but, examined separately, each stage would be finite and imperfect. It is by intuitional perception of the principle of continuity in the logic of nature that we connect the invisible with the vis-

ible systems in the correlation of phenomena, both in the organic and inorganic realms of organization. Our fundamental assumption is, that the law and order which we perceive in nature necessarily imply and denote intelligent purpose; and life and mind define that purpose as the evolution of spiritual being, thereby indicating and postulating the persistence of psychic life beyond the present range of human intellection. By psychic selection, mind must dominate body in an ever-increasing degree, to which no limit can be set. If the purely utilitarian, determinist, and mechanical aspects of evolution be insisted upon, it is impossible to account (and we need not apologize) for the remarkable development of psychic function, which compels man to subordinate his material advancement to the dictates of his conscience and his sense of duty. Self-sacrifice and not self-preservation is characteristic of those whom we honor and love; and it is in the equitable or rational adjustment between egoism and altruism that we recognize the sanity and virility of the race. Race-instinct cannot be divorced from the persistent force which creates heroes out of men, martyrs out of saints, and seers out of thinkers. *Ideas rule the world.* What will people, ten thousand years hence, think of our philosophy? Surely, we must make provision for some intelligent development in the expansion of thought. It takes much weight of wisdom to plumb the depth of our ignorance—the greater the wisdom, the greater the depth—but shallow fools reach mud with surprising ease. The revolt of man against spiritual extinction is a tribute to his intelligence, which demands a *meaning* for life and mind, other than the reproduction of species.

ARTHUR SILVA WHITE.

LONDON, ENGLAND.

THE PRINCIPLES OF MECHANICS WITH NEWTON FROM 1679 TO 1687.*

I.

MANY times on the subject of Newton's optical publications, Hooke had claimed priority, and there was in consequence some friction between Hooke and Newton. That such disputes were agreeable neither to Hooke nor to Newton appears from letters which passed between them in 1676.[1]

It is probable that the intermeddling friend, referred to by Hooke, who stirred up strife between them by painting Hooke in dark colors to Newton was Henry Oldenburg, the secretary of the Royal Society.[2] In the disputes between Hooke and Hevelius on the subject of plain and telescopic sights, and between Hooke and Huygens about the invention of pendulum clocks, Oldenburg took a keen and active part against Hooke. However, in a later dispute of 1686, and therefore long after Oldenburg's death, Halley remarked to Newton that he feared that Hooke's manner of claiming the discovery of the law of the inverse squares had been "represented in worse colors than it ought."[3]

* The references are mainly to the works mentioned in my previous article in this journal (April, 1914) on "The Principles of Mechanics with Newton up to 1679."

[1] Brewster, *op, cit.*, pp. 140-143.

[2] *Ibid.*, pp. 143-144.

[3] Rouse Ball, *op. cit.*, p. 163; Brewster, *op cit.*, p. 144.

We shall now have to consider some correspondence that passed between Hooke and Newton in 1679 and 1680, which is very important, since it was the means of turning Newton's thoughts again to the subject of gravitation. It also forms the ground-work of the claim put forward later by Hooke to the discovery of the Newtonian theory of gravitation.

The "Royal Society for the improving of Natural Knowledge" was founded in 1662.[4] As mentioned in my article on "Robert Hooke as a Precursor of Newton,"[5] Hooke was its first "curator of experiments" and Henry Oldenburg its first secretary. When[6] Oldenburg died in 1677 Hooke succeeded him as secretary, and wrote to Newton on November 24, 1679, as follows:[7]

"Sir,

Finding by our registers that you were pledged to correspond with Mr. Oldenburg, and having also had the happiness of receiving some letters from you myself, make me presume to trouble you with this present scribble—Dr. Grew's more urgent occasions having made him decline the holding correspondence. And the Society has devolved it on me. I hope, therefore, that you will please to continue your former favors to the Society by communicating what shall occur to you that is philosophical, and, for return, I shall be sure to acquaint you with what we shall receive considerable from other parts, or find out new here. And you may be assured that whatever shall be so communicated shall be no otherwise further imparted or disposed of than you yourself shall prescribe. I am not ignorant that both heretofore, and not long since also, there have been some who have endeavored to misrepresent me to you, and possibly they or others have not been wanting

[4] It celebrated its 250th anniversary in July, 1912.
[5] *Monist*, July, 1913, § 1.
[6] Cf. *ibid.*, § VII.
[7] Rouse Ball, *op. cit.*, pp. 139-140.

[lacking] to do the like to me; but difference in opinion, if such there be, should not, especially in philosophical matters where interest hath little concern, methinks, be the occasion of enmity—it is not with me, I am sure. For my part I shall take it as a great favor if you shall please to communicate by letter your objections against any hypothesis or opinion of mine; and particularly if you will let me know your thoughts of that of compounding the celestial motions of the planets out of a direct motion by the tangent and an attractive motion towards the central body, or what objections you have against my hypothesis of the laws or causes of springiness."

Thus began the first letter of a correspondence[8] through which Newton was, as Pemberton says, led to inquire what was the real figure in which a body, let fall from any high place, descends, taking the motion of the earth round its axis into consideration; and, as Newton acknowledged in a letter[9] written in 1686 to Halley:

"This is true, that his [Hooke's] letters occasioned my finding the method of determining figures, which, when I had tried in the ellipsis, I threw the calculations by, being upon other studies; and so it rested for about five years, till upon your request I sought for that paper; and not finding it, did it again, and reduced it into the propositions shown you by Mr. Paget: but, for the duplicate proportion,

[8] Brewster, *op. cit.*, Vol. I, pp. 291-292, 254-255; Rouse Ball, *op. cit.*, pp. 18-24, 139-150, 155-167. It is very likely that Newton had his attention first directed to Picard's measurement by Hooke (see below), and Brewster (*op. cit.*, pp. 291-292; cf. Rouse Ball, *op. cit.*, pp. 22-24) seems wrong in stating that Newton did not resume his former thoughts concerning the moon till 1684 (cf. Pemberton in Rouse Ball, *op. cit.*, p. 20). It is amusing to compare Conduitt's (Brewster, *op. cit.*, pp. 291-292) version of the correspondence with Hooke with the actual letters; for Conduitt stated that he got his information from Newton. Newton, in his first letter to Hooke, explicitly said "spiral line"; Conduitt attributed the error to a "negligent stroke of the pen" in the diagram. Newton himself wrote to Halley on May 27, 1686: "In the scheme wherein I explained this, I carelessly described the descent of the falling body in a spiral to the center of the earth: which is true in a resisting medium, such as our air is." Cox (*op. cit.*, p. 93) is mistaken in saying that Newton worked out the details of his discovery from 1672 (when Picard communicated his results to the Royal Society) to 1674.

[9] Rouse Ball, *op. cit.*, p. 165.

I can affirm that I gathered it from Kepler's theorem about twenty years ago."

Again, in a letter written to Halley thirteen days afterwards, Newton said:[10]

"And, though his correcting my spiral occasioned my finding the theorem by which I afterwards examined the ellipsis, yet am I not beholden to him for any light into the business, but only for the diversion he gave me from my other studies to think on these things, and for his dogmaticalness in writing as if he had found the motion in the ellipsis, which inclined me to try it, after I saw by what method it was to be done."

For this reason we will here consider the correspondence in some detail.

In the first letter Hooke, after the opening paragraph quoted above, mentioned two things. Firstly, he desired to know Newton's opinion of a hypothesis of the heavens, invented by Mallemont de Messanges;[11] and, secondly he mentioned that Picard and others were making geodetical observations in France.[12] "I am informed, likewise from Paris, that they are there about another work, viz., of settling the longitude and latitude of the most considerable places: the former of those by the eclipses of the satellites of Jupiter. MM. Picart and De la Hire travel, and MM. Cassini and Romer observe at Paris. They have already found that Brest in Brittany is eighteen leagues nearer Paris than all the maps make it. I have written to a correspondent in Devonshire to see if he can do somewhat of that kind here, and I should be glad if, by perpendicular observations, we could determine the difference of latitude between London and Cambridge. If you know of any one that will observe at Cambridge, I will procure it to be done here very exactly."

[10] *Ibid.*, 167.
[11] On this man, see Rigaud, *op. cit.*, pp. 42-43.
[12] Rouse Ball, *op. cit.*, p. 140.

Hooke finally gave some small items of news about a book by De la Hire and some observations of Flamsteed's.

This letter was copied by Rouse Ball from a rough draft in Hooke's handwriting which is in the Library of Trinity College, Cambridge;[13] and it must be remembered when reading Rigaud's *Essay*,[14] that Rigaud had not seen this correspondence.

It was probably this letter which led Newton to use Picard's estimate in the revision of his calculation.[15]

Newton replied on Nov. 28, 1679,[16] and his letter began:

"I cannot but acknowledge myself every way by the kindness of your letter tempted to concur with your desires in a philosophical correspondence. And heartily sorry I am that I am at present unfurnished with matter answerable to your expectations—for I have been this last half year in Lincolnshire cumbered with concerns amongst my relations till yesterday when I returned hither; so that I have had no time to entertain philosophical meditations, or so much as to study or mind anything else but country affairs. And before that, I had for some years last been endeavoring to bend myself from philosophy to other studies, in so much that I have long grudged the time spent in that study unless it be perhaps at idle hours sometimes for a diversion; which makes me almost wholly unacquainted with what philosophers at London or abroad have of late been employed about. And perhaps you will incline the more to believe me when I tell you that I did not, before the receipt of your last letter, so much as hear (that I remember) of your hypothesis of compounding the celestial motions of the planets out of a direct motion by

[13] *Ibid.*, p. 139.

[14] Cf. pp. 12, 37, 42.

[15] Rouse Ball, *op. cit.*, p. 23; cf. the quotation of Pemberton's confirmatory evidence and Robison's—probably mistaken—account on pp. 20-23. Cf. Brewster, *op. cit.*, 292.

[16] Rouse Ball, *op. ct.*, pp. 141-144.

the tangent to the curve, and of the laws and causes of springiness, though these no doubt are well known to the philosophical world. And having thus shook hands with philosophy and being also at present taken up with other business, I hope it will not be interpreted out of any unkindness to you or the Royal Society that I am backward in engaging myself in these matters, though formerly I must acknowledge I was moved by other reasons to decline, as much as Mr. Oldenburg's importunity and ways to engage me in disputes would permit, all correspondence with him about them. However I cannot but return my hearty thanks for your thinking me worthy of so noble a commerce and, in order thereto, frankly imparting to me several things in your letter."

In a letter of June 20, 1686, to Halley, Newton thus[17] described this correspondence:

". . . .In my answer to his first letter I refused his correspondence, told him I had laid philosophy aside, sent him only the experiment of projectiles (rather shortly hinted than carefully described), in compliment to sweeten my answer, expected to hear no further from him; could scarce persuade myself to answer his second letter; did not answer his third,—was upon other things; thought no further of philosophical matters than his letters put me upon it, and therefore may be allowed not to have had my thoughts of that kind about me so well at that time."

Indeed, Newton, after briefly discussing Mallemont's hypothesis, and after referring to a possible determination of latitude and to Flamsteed's observations,[18] proceeded[19]:

"In requital of this advertisement, I shall communicate to you a fancy of my own about discovering the earth's diurnal motion. In order thereto, I will consider the earth's diurnal motion alone, without the annual, that hav-

[17] *Ibid.*, p. 157.
[18] *Ibid.*, p. 142.
[19] *Ibid.*, pp. 142-143.

ing little influence on the experiment I shall here propound. Suppose then BDG represents the globe of the earth carried round once a day about its center C from west to east, according to the order of the letters BDG; and let A be a heavy body suspended in the air, and moving round with the earth so as perpetually to hang over the same point thereof, B. Then imagine this body A let fall; its gravity will give it a new motion towards the center of the earth without diminishing the old one from west to east. Whence the motion of this body from west to east, by reason that before it fell it was more distant from the center of the earth than the parts of the earth at which it arrives in its fall, will be greater than the motion from west to east of the parts of the earth at which the body arrives in its fall; and therefore the body will not descend the perpendicular AC, but, outrunning the parts of the earth, will shoot forward to the east side of the perpendicular, describing in its fall a spiral line ADEC, quite contrary to the opinion of the vulgar who think that, if the earth moved, heavy bodies in falling would be outrun by its parts and fall on the west side of the perpendicular. The advance of the body from the perpendicular eastward will, in a descent of but twenty or thirty yards, be very small, and and yet I am apt to think it may be enough to determine the matter of fact. Suppose, then, in a very calm day, a pistol bullet were let down by a silk line from the top of a high building or well, the line going through a small hole made in a plate of brass or tin fastened to the top of a building or well; and that the bullet when let down almost to the bottom were settled in water so as to cease from swinging, and then let down further on an edge of steel lying north and south to try if the bullet in settling thereon will almost stand *in aequilibrio* but yet with some small propensity (the smaller the better) decline to the west side of the steel as often as it is so let down thereon. The steel being so placed underneath,

suppose the bullet be then drawn up to the top and let fall by cutting, clipping, or burning the line of silk. If it fall constantly on the east side of the steel, it will argue the diurnal motion of the earth. But what the event will be I know not, having never attempted to try it. If anybody would think this worth their trial, the best way, in my opinion, would be to try it in a high church or wide steeple, the windows being first well stopped; for, in a narrow well, the bullet possibly may be apt to receive a ply from the straitened air near the sides of the well, if in its fall it come nearer to one side than to another. It would be convenient also that the water into which the bullet falls be a yard or two deep or more, partly that the bullet may fall more gently on the steel, partly that the motion which it has from west to east at its entry into the water may, by means of the longer time of descent through the water, carry it on further eastward and so make the experiment more manifest."

In the figure which accompanied this letter, the path of the falling body from A to D was indicated by a dotted line which was continued into the interior of the earth, and, after having turned once round the center C, ended at C. This is the spiral often referred to below, as well as by Newton in a note above.

This letter was read to the Royal Society on Dec. 4, 1679, as appears by the following minute:[20]

"Mr. Hooke produced and read a letter of Mr. Newton to himself dated 28th November, 1679, containing his sentiments of Mallemont's new hypothesis of the heavens; and also suggesting an experiment whereby to try whether the earth moves with a diurnal motion or not, viz., by the falling of a body from a considerable height, which, he alleged, must fall to the eastward of the perpendicular, if the earth moved. This proposal of Mr. Newton's was highly ap-

[20] Birch, *op. cit.*, Vol. III, 1757, pp. 512-513; Rouse Ball, *op. cit.*, p. 145.

proved of by the Society; and it was desired that it might be tried as soon as could be with convenience. Sir Christopher Wren supposed that there might be something of this kind tried by shooting a bullet upwards at a certain angle from the perpendicular round every way, thereby to see whether the bullets so shot would all fall in a perfect circle round the place where the barrel was placed. This barrel he desired might be fixed in a frame upon a plane foot, and that foot placed upon a true plane every way, and the mouth of the gun be almost in the same point over the plane which way soever shot. Mr. Flamsteed hereupon alleged that it was an observation of the gunners that, to make a ball fall back into the mouth of the piece, it must be shot at eighty-seven degrees; and that he knew the reason thereof; and that it agreed with his theory; and that a ball shot perpendicularly would never fall perpendicularly; and he mentioned the recoiling of a perpendicular jet of water. But this was conceived to arise from some mistake of the gunners in not well taking notice of all circumstances; since a body shot perpendicularly would also descend perpendicularly; and a body shot at eighty-seven degrees would fall considerably distant from the place where it was shot."

Newton's letter then ended:[21]

"If I were not so unhappy as to be unacquainted with your hypothesis above mentioned (as I am with almost all things which have of late been done or attempted in philosophy), I should so far comply with your desire as to send you what objections I could think of against them, if I could think of any. And, on the other hand, I could with pleasure hear and answer any objections made against any notions of mine in a transient discourse for a divertisement. But yet, my affection to philosophy being worn out, so that I am almost as little concerned about it as one

[21] Rouse Ball, *op. cit.*, p. 144.

tradesman uses to be about another man's trade or a country man about learning, I must acknowledge myself averse from spending that time in writing about it which I think I can spend otherwise more to my own content and the good of others; and I hope neither you nor anybody else will blame me for this averseness. To let you see that it is not out of any shyness, reservedness, or distrust that I have of late and still do decline philosophical commerce, but only out of my applying myself to other things, I have communicated to you the notion above set down (such as it is) concerning the descent of heavy bodies for proving the motion of the earth; and shall be as ready to communicate in oral discourse anything I know, if it shall ever be my happiness to have familiar converse frequently with you. And possibly if anything useful to mankind occurs to me I may sometimes impart it to you by letter."

Hooke replied on Dec. 9, 1679, by a letter which has been lost. A note, however, written by Hooke, contains the words:[22]

"Dec. 9th, 1679, in a letter to Newton, Hooke has these words upon an account of an experiment about the falling of a ball from a considerable height: I could add many other considerations consonant to my theory of circular motions compounded by a direct motion and an attractive one to the center, etc."

It was read to the Royal Society on Dec. 11, 1679:[23]

"Upon the mentioning of Mr. Newton's letter and the experiment proposed in it, Mr. Hooke read his answer to him upon that subject, wherein he explained what the line described by a falling body must be supposed to be, moved

[22] *Ibid.*, pp. 152-153.

[23] Birch, *op. cit.*, Vol. III, p. 516; Rouse Ball, *op. cit.*, p. 146; Rigaud, *op. cit.*, pp. 12-13. This extract has already been given, in rather different words of Waller's, in § VII of my article on Hooke (*Monist*, July, 1913).

circularly by the diurnal motion of the earth and perpendicularly by the power of gravity: and he showed that it would not be a spiral line, as Mr. Newton seemed to suppose, but an excentrical elliptoid [*sic*], supposing no resistance in the medium: but, supposing a resistance, it would be an excentric ellipti-spiral, which, after many revolutions, would rest at last in the center; that the fall of the heavy body would not be directly east, as Mr. Newton supposed, but to the south-east, and more to the south than the east. It was desired that what was tryable in this experiment might be done with the first opportunity."

Besides this, Rigaud[24] wrote:

"On the 11th of Dec., 1679,[25] he [Hooke] had explained that the body in its fall would be carried towards the south as well as towards the east, and this he described as having occurred in actual trial; but at the same time it is to be acknowledged that the coincidence must have been the consequence of accidental circumstances, since the fall, being only 27 feet, was too small to produce a deviation which he could have appreciated."

With regard to the further history of Newton's problem, we may remark, after Rigaud,[26] that it was treated by Thomas Simpson[27] and d'Alembert.[28] The experiment has also been tried with success by Gulielmini, Henzenberg, and Flaugergues, from stations of very great height; but still there are so many difficulties attending it that Delambre[29] considered it as by no means conclusive. It was found, indeed, by mathematicians that the deviation to the south is exceedingly small for any case in which it can be actually tried.

[24] *Op. cit.*, p. 44.
[25] Birch, *op. cit.*, Vol. III, p. 11.
[26] *Op. cit.*, pp. 44-45.
[27] *Mathematical Dissertations*, 1743, p. 160.
[28] *Histoire de l'Académie de Paris*, 1771, p. 10.
[29] *Astronomie*, Vol. II, p. 192.

II

We now come to the question of the spiral.[1] If the earth were at rest, a heavy body would fall in a straight line towards its center, but if the motion communicated by the rotation acts as a projectile force, the combination of it with gravity would, Newton at first hastily stated, make the body descend in a spiral. Biot[2] said that doubtless Newton came to this conclusion because he supposed the fall to be in a resisting medium like the air, and this, at first sight, seems very probable, especially when we consider what is laid down in the fourth section of the second book of the *Principia*. But, said Rigaud, Newton said nothing to confirm this conjecture[3]: on the contrary, he rested his defence upon being engaged on other pursuits, so that "I thought no further of philosophical matters than his letters put me upon it, and therefore may be allowed not to have had my thoughts of that kind about me so well at that time." Indeed the proposition was probably not communicated as the result of his own speculations, but as it casually occurred to his recollection in the act of writing. He had not then demonstrated the law of central forces, and the early impression of their effect seems very generally to have been that revolving bodies might ultimately fall down to the point to which they were attracted. This naturally led to the idea of a spiral path. Leonardo da Vinci had assigned it to them, and it had been maintained nearer to Newton's own time and under circumstances which were more likely to be present to his thoughts. There had been a controversy, in which the arguments derived by Riccioli from falling bodies against the earth's motion were answered by Stephanus de Angelis. An account of what passed

[1] Rigaud, *op. cit.*, pp. 45-47.

[2] In his biography of Newton in the *Biographie Universelle*, Vol. XXXI, p. 149; Eng. Trans., p. 14.

[3] Rigaud had not seen Newton's letter to Halley of May 27, 1686, mentioned in one of the preceding notes and confirming Biot's conjecture.

between them was drawn up by James Gregory, and published in the second volume of the *Philosophical Transactions*. Mention was made, at the end, of the experiment tried by Descartes of discharging cannon balls perpendicularly in the air, and of their falling back to the surface more frequently to the west than to the east. This experiment, possibly too difficult of accurate execution to be at all relied upon, was brought forward in confirmation of the earth's motion, and it may have suggested that which Newton recommended for the same purpose. As De Angelis had argued against the false position of his antagonist, his views may have been received with the more favor. Now he assumed the spiral motion, although it is not noticed by Gregory, as we see by the preface to his tract *De infinitis spiralibus inversis*.[4]

Among David Gregory's papers there is, said Rigaud,[5] a memorandum that "Mr. Newton pursued the motion of the planets first on supposition of an equal gravity, but afterwards wrote to Mr. Hooke, asking what he suspected the law of gravity to be." That Newton, before 1666, may at first have entertained such an idea of gravitation as is here described is very possible; but it is most evident, from Hooke's own statement, that his letter in 1679 originated with himself, and was no reply to any application which Newton had made to him.

III.

The line of argument which Newton adopted in this correspondence with Hooke supplies, said Rigaud,[1] a con-

[4] Pat. 1667: "Jam anni quadrans evolvit, ex quo discursus quidam nostri Italice conscripti prodiere; in quibus rationes aliquot physico-mathematicas contra Copernicum systema a viro eximio Ricciolio excogitatas, ad trutinam revocavimus. Affirmabamus tunc bina genera infinitarum spiralium a nobis fuisse contemplata; spatiaque ab ipsis clausa geometrice mensurata; quarum una illa foret, quae a gravi naturaliter cadente in plano aequatoris describeretur, is Tellus, ex falsa hypothesi, motu diurno duntaxat moveretur, et grave deorsum latum taliter suum concitaret motum, ut spatia, ab ipso peracta, forent ad invicem ut ipsa quadrata temporum." See also p. 17, and *Cartesii Epist.*, Part. prim., pp. 162, 173.

[5] *Op. cit.*, p. 47. [1] *Op. cit.*, pp. 48, viii.

firmation of his not having yet made use of Picard's measures for the correction of his first calculations. If he had himself "experimentally verified" his hypothesis, he would have hardly failed to mention it when he repeatedly pointed out Hooke's deficiency in this respect; and he distinctly said that, "before a certain demonstration" which he found in 1685, he had suspected that the law of the inverse squares "did not reach accurately enough down so low" as "the superficies of the earth," "and therefore in the doctrine of projectiles never used it nor considered the motion of the heavens." However this may be, he clearly followed his own precise rule of philosophizing: "In experimental philosophy we are to look upon propositions collected by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur by which they may either be made accurate or liable to exceptions."

Hooke's process, said Rigaud,[2] was much less strict; and, although it enabled him to take one great step towards the truth, it did not put him in possession of it either completely or with certainty. He saw the analogy between the moon's motion and that of the primary planets, and accordingly extended the law of the inverse squares to terrestrial gravitation, without knowing that this law of the effect ceased at the surface of the earth. He had left the verification of his theory to his readers in 1674, which made Newton very justly complain[3] that he should claim the honor of discovery for himself, and throw upon others the drudgery of ascertaining whether after all it was applicable to the facts. It is probable that he had only adopted the precise law of variation when he wrote to Newton in 1679. Hooke satisfied himself "that the proportion was

[2] *Op. cit.*, pp. 49-50, viii.

[3] Letter to Halley of June 20, 1686; Rouse Ball, *op. cit.*, p. 159.

duplicate *quam proxime* at great distances from the center, and only guessed it to be so accurately,"[4] but without Newton's demonstrations, to which he was a stranger, he had advanced no further than to an imperfect though beautiful conjecture. It may likewise be added that he had not that clear and steady view of his own first principles which, if he had attempted it, would have enabled him to arrive at more certain conclusions. In a lecture which he delivered as late as the 25th of May, 1687, he said: "I know that if the gravitating power in the sun and moon be exactly the same with that of the earth, the query I propounded can have no ground; but, though they may in most particulars be consonant, as I shall prove in my theory of gravity, yet there may be a cause (and there seems to be some assignable) why there may be something specific in each of them."

Arguing from the analogies which he had adopted, Hooke rejected Newton's suggestion of a spiral motion for the projectile, and said that its path would be an elliptical curve, but he did not venture the assertion of its being an ellipse: he only called it an eccentrical ellipsoid; and added that, supposing the motion to take place in a resisting medium, the path would become an "eccentric ellipti-spiral."

IV.

Hooke certainly saw that the earth must be oblate at the poles; mention was made of this theory in many parts of his writings, and particularly in his *"Discourse on Earthquakes,"* which Waller, the editor of his *Posthumous Works,* considered to have been written before 1667. He considered the solid part of the earth to be an exterior shell, and reasoned as to the figure which it assumed, from the different degrees of centrifugal force of the parts at

[4] *Ibid.,* p. 158.

different distances from the axis of rotation. Now this was a fact of which Newton did not need to be informed, for, in comparing the moon's orbit in 1666 with the effect of gravity, he calculated (as he said) "the force of ascent at the equator arising from the earth's motion"; and he resolved the problem more completely than it had ever been contemplated by Hooke, who assumed as the foundation of his argument that "the gravitating power of the earth be everywhere equal, as I know no reason to suppose the contrary"; and said that the waters of the sea may, at the poles, have a plane, if not a concave surface.[1]

V.

Newton replied to Hooke's letter of Dec. 9, but the reply is lost.[1] When Hooke said that the path was not a spiral but an "eccentrical elliptoid," or as Newton put it in a letter to Halley of 1686,[2] "Mr. Hooke replied it would not descend to the center but at a certain limit return upwards again. I then took the simplest case for computation, which was that of gravity uniform in a medium not resisting, imagining he had learned the limit from some computation, and for that end had considered the simplest case first. And in this case I granted what he contended for, and stated the limit as nearly as I could." In his reply of Jan. 6, 1680,[3] Hooke began:

"Your calculation of the curve described by a body attracted by an equal power at all distances from the center, such as that of a ball rolling in an upward concave cone, is right, and the two auges will not unite by about a third of a revolution; but my supposition is that the attraction always is in duplicate proportion to the distance from the center reciprocal, and consequently that the ve-

[1] Rigaud, *op. cit.*, p. 67.
[1] Rouse Ball, *op. cit.*, pp. 146-147.
[2] *Ibid.*, p. 155.
[3] *Ibid.*, p. 147.

locity will be in a subduplicate proportion to the attraction, and consequently, as Kepler supposes, reciprocal to the distance. and that with such an attraction the auges will unite in the same part of the circle, and that the nearest point of the access to the center will be opposite to the farthest distant, which I conceive doth very intelligibly and truly make out all the appearances of the heavens. And therefore (though in truth I agree with you that the explicating the curve in which a body descending to the center of the earth would circumgyrate were a speculation of no use, yet) the finding out the properties of a curve made by two such principles will be of great concern to mankind, because the invention of the longitude by the heavens is a necessary consequence of it, for the composition of two such motions I conceive will make out that of the moon. What I mentioned in my last concerning the descent within the body of the earth was but upon the supposal of such an attraction, not that I really believe there is such an attraction to the very center of the earth, but, on the contrary, I rather conceive that the more the body approaches the center the less will it be urged by the attraction, possibly somewhat like the gravitation on a pendulum or a body moved in a concave sphere where the power continually decreases the nearer the body inclines to a horizontal motion which it has when perpendicular under the point of suspension or in the lowest point, and there the auges are almost opposite, and the nearest approach to the center is at about a quarter of a revolution. But, in the celestial motions, the sun, earth, or central body is the cause of the attraction, and, though they cannot be supposed mathematical points, yet they may be conceived as physical, and the attraction at a considerable distance may be computed according to the former proportion as from the very center. This curve truly calculated will show the error of those many lame shifts made use of by

astronomers to approach the true motions of the planets with their tables. But of this more hereafter."

Hooke then[4] gave an account of his trials of the "noble experiment" of the falling body, and added: "If it doth succeed there will follow several other consequences not less considerable—as, first, that all bodies will, in consequence, grow lighter the nearer they approach the equinoctial, the circular motion being the swifter, and for the same reason the further a body is from the center the less will be its gravitation, not only on account of the decrease of the attractive power, which I have a long time supposed, but upon the increase of the endeavor of recess. And this gives us another way to try whether the earth has a diurnal motion, though much short of what you proposed. But that I may tell you somewhat of observation, Mr. Halley, when he returned from St. Helena, told me that his pendulum at the top of the hill went slower than at the bottom, which he was much surprised at, and could not imagine a reason. But I presently told him that he had solved me a query I had long desired to be answered but wanted opportunity, and that was to know whether the gravity did actually decrease at a greater height from the center. To examine this decrease of attraction I have formerly made many experiments on Paul's steeple and Westminster Abbey, but none that were fully satisfactory. This will spoil the universal standard by the pendulum and the equality of pendulum clocks carried from one climate to another."

Newton said of this letter in 1686:[5]

"He replied that gravity was not uniform but increased in descent to the center in a reciprocal duplicate proportion of the distance from it, and thus the limit would be otherwise than I had stated it, namely, at the end of every entire revolution, and added that, according to this duplicate

[4] *Ibid.*, p. 148; cf. pp. 148-149.
[5] *Ibid.*, p. 155.

proportion, the motions of the planets might be explained and their orbs defined. This is the sum of what I remember."

Later he remembered something else:[6]

"He told me that my proposed experiment about the descent of falling bodies was not the only way to prove the motion of the earth; and so added the experiment of your pendulum clock at St. Helena as an argument of gravity's being lessened at the equator by the diurnal motion. The experiment was new to me, but not the notion; for, in that very paper which I told you was writ some time above fifteen years ago, I calculated the force of ascent at the equator, arising from the earth's diurnal motion, in order to know what would be the diminution of gravity thereby. But yet to do this business right is a thing of far greater difficulty than I was aware of."

Hooke again referred to the problems on orbits under attraction in a letter of Jan. 17, 1680,[7] where also the experiments were further referred to,[8] and then the correspondence on this subject closed.

With the controversy[9] which arose out of this correspondence, I shall not deal in any detail. The facts on which Hooke's claims were based are given above and in the following references.

With Hooke's *Attempt to prove the Annual Motion of the Earth* of 1674, which had been previously read to the Royal Society at Gresham College, I have already dealt in section V of "Robert Hooke as a Precursor of Newton."[10] His *De Cometa* of 1678 was dealt with in section VI, and

[6] *Ibid.*, p. 165.

[7] *Ibid.*, p. 149.

[8] Cf. *ibid.*, p. 150.

[9] Cf. Hooke's notes (*ibid.*, pp. 150-153, 144-145); Newton's correspondence of 1686 with Halley (*ibid.*, pp. 154-155, 156-167); *ibid.*, pp. 68-73; and Rigaud, *op. cit.*, pp. 37-71.

[10] *Monist*, July, 1913..

his early paper of 1666 and a pendulum experiment in section III.

Hooke wrote, in the letter[11] of Sept. 15, 1689, which was to pass for Aubrey's to Antony Wood, that he wrote to Newton "to make a demonstration of *this theory* [in Hooke's *Attempt*] *not* telling him *at first* the proportion of the gravity to the distance, [and] *nor what was* the curved line that was thereby made.

"Mr. Newton, in his answer to the letter, *did express* that he had not thought of it; and in his first attempt about it, he calculated the curve by supposing the attraction to be the same at all distances."

Thus Newton was led to consider what would be the form of the curve which a body projected from a point and acted upon by a central attraction varying inversely as the square of the distance would describe. Then too he established the theorem relating to the equal description of areas, and discovered the method of determining the law of central force in order that any given orbit might be described under its action. He applied this to the ellipse and proved that this curve would be described under the action of a force in the focus varying inversely as the square of the distance.[12]

VI.

According to J. W. L. Glaisher, in his address delivered on the bicentenary of the publication of the *Principia,* Newton's thoughts were, in 1666, carried from the earth to the moon. Kepler's laws had reference to the sun and planets, so we may safely assume that Newton's mind had grasped the idea of a single principle of gravitation governing the motions of bodies on earth and in the heavens.

[11] Rigaud, *op. cit.,* App. No. XIII, p. 52. Hooke's interlineations are printed in italics.

[12] This is from Glaisher's account referred to below, which is partly based on the manuscript note of Newton's reproduced above from Rouse Ball's book, pp. 6-7. Cf. Rouse Ball, *op. cit.,* pp. 20-21.

This appears to be similar to the opinion of Adams referred to above. In this view there are three distinct steps in Newton's great discovery; the first is physical and the other two are mathematical. The first is the conception, that was present to Newton's mind in 1666, that all the particles of matter in the earth and the moon attract each other according to the law of the inverse square; the second is the mathematical investigations of 1679; and the third is the theorem of 1685 on the attraction of a sphere.

By this determination of the attraction of a sphere on an external particle,[1] and by the unexpected—as Newton himself said—finding that this attraction is directed to the center of this sphere, Newton saw, as Glaisher[2] has put it, all the mechanism of the universe at once spread out before him. "When he discovered the theorems that form the first three sections of Book I, when he gave them in his lectures of 1684, he was unaware that the sun and earth exerted their attractions as if they were but points. How different must these propositions have seemed to Newton's eyes when he realized that these results, which he had believed to be only approximately true when applied to the solar system, were really exact! Hitherto they had been true only in so far as he could regard the sun as a point compared to the distance of the planets or the earth as a point compared to the distance of the moon—a distance amounting to only about sixty times the earth's radius—but now they were mathematically true, excepting only for the slight deviation from a perfectly spherical form of the sun, earth, and planets. We can imagine the effect of this sudden transition from approximation to exactitude in stimulating Newton's mind to still greater efforts. It was now in his power to apply mathematical analysis with absolute precision to the actual problems of astronomy."

[1] Rouse Ball, *op. cit.*, pp. 11, 35, 61, 157.
[2] *Ibid.*, p. 61.

The discovery of the theorem by which the attraction of a spherical mass is determined was thus rightly emphasized by Glaisher—as it was by Edleston[3] — as an immensely important—perhaps in a sense the most important —of Newton's researches on gravitation. But when Newton said, as he did in the letter of 1686 already quoted,[4] that he never "considered the motions of the heavens" before he discovered this theorem in 1685, his statement is so plainly wrong that an "it in"—where the "it" refers to the law of attraction below the surface of the attracting body—must have been omitted by mistake between the "considered" and the "the."

Hooke, in his paper read to the Royal Society on March 21, 1666,[5] said:[6] "If all the parts of the terrestrial globe be magnetical, then a body, at a considerable depth below the surface of the earth, should lose somewhat of its gravitation or endeavor downwards by the attraction of the earth placed above it. This opinion some experiments made by some worthy persons of this honorable society seem to countenance"; but he pointed out the difficulty of conducting them in a conclusive manner and referred to the trial by clocks at certain depths and heights which, as Whewell[7] remarked, had been previously suggested by Bacon.

When Newton's temper was roused, he did not delay to imagine that Hooke might be a plagiarist;[8] but he was easily pacified.[9] Still, even then, he did not allow generosity to occupy too large a place in his just acknowledg-

[3] *Op. cit.*, p. xxix. In 1685, said Edleston, Newton "determines the attractions of masses and thus completes the demonstration of the law of universal gravitation."

[4] Rouse Ball, *op. cit.*, p. 157.

[5] See Section II of "Robert Hooke as a Precursor of Newton," *Monist*, July, 1913. Cf. Rigaud, *op. cit.*, pp. 56-58.

[6] Birch, *op. cit.*, Vol. II, p. 70.

[7] *History of the Inductive Sciences*, Vol. II, p. 173.

[8] Rouse Ball, *op. cit.*, p. 160.

[9] *Ibid.*, p. 165.

ments.[10] Newton's suspicions seem to have been very easily roused with regard to both enemies and friends. Worse than this is the way in which Newton, doubtless in one of his irritable fits, laid implicit or explicit claim to merits which he did not possess at the time under discussion. In a more generous moment he admitted[11] that Hooke was correct about the spiral; but, in the angry postscript, he said:[12]

"For his extending the duplicate proportion down to the center (which I do not) made him correct me, and tell me the rest of his theory as a new thing to me, and now stand upon it that I had all that from his letter, notwithstanding that he had told it to all the world before, and I had seen it in his printed books, all but the proportion."

Does not this imply that Newton was too cautious to consider the path below the surface of the earth? We know, from the letter he wrote to Hooke in 1679 and which is reproduced above, that he was not so cautious then. He had no inkling then of what he knew in 1686.

We must remember that this is not an isolated case. If it were, we would not suspect Newton of a slight meanness on no better evidence. But to throw discredit on Leibniz's infinitesimal calculus, he denied that he had ever used infinitesimal methods. On this De Morgan[13] remarked:

"We are of opinion that the *moral intellect* of Newton —not his moral *intention*, but his power of judging— underwent a gradual deterioration from the time when he settled in London. We see the faint traces of it in his manner of repudiation of the *infinitesimal* view of fluxions, in 1704. A man of sound judgment as to what is right

[10] *Ibid.*, pp. 165-167.

[11] *Ibid.*, pp. 165, 167. See above, §§ I-III, V.

[12] *Ibid.*, p. 160.

[13] Review of Brewster in *North British Review*, Vol. XXIII, 1855, pp. 324-325. This review is included in De Morgan's *Essays on the Life and Work of Newton*, just published by the Open Court Publishing Company.

does not abandon a view which he has held in common with a great rival, and this just at a time when the world is beginning to ask which came first in their common discovery, without a clear admission of the abandonment: he does not imply that *some* have held that view, and declare against the opinion of those *some,* without a distinct statement that he himself had been one of them: still less does he quietly and secretly alter what he had previously published, or allowed to be published, so as to turn the old view into the new one, and to leave the reader to understand that he had never changed his opinion. The Newton of the mythologists would have felt to his fingers' ends that such a proceeding had a tendency to give false impressions as to the case, and to throw suspicion on his own motives. This is a small matter, but it is a commencement of worse. We come to the *Commercium epistolicum,* the name given to the collection of letters accompanied by notes and a decision of the question, on the part of a Committee of the Royal Society. To this well-known part of the history Sir D. Brewster has a very important addition to make; and he makes it fairly, though we confess we wish he had given us what they call chapter and verse. 'It is due to historical truth to state that Newton supplied all the materials for the *Commercium epistolicum,* and that, though Keill was its editor, and the Committee of the Royal Society the authors of the Report, Newton was virtually responsible for its contents.' "

VII.

In the angry postscript to his letter written to Halley on June 20, 1686,[1] Newton seems to have laid his finger on the exact spot of Hooke's failure and his success:

"For it is plain, by his [Hooke's] words, that he knew now how to go about it. Now is not this very fine? Mathe-

[1] Rouse Ball, *op. cit.,* pp. 159-160.

maticians that find out, settle, and do all the business, must content themselves with being nothing but dry calculators and drudges; and another that does nothing but pretend and grasp at all things must carry away all the invention, as well of those that were to follow him as of those that went before. Much after the same manner were his letters writ to me, telling me that gravity, in descent from hence to the center of the earth, was reciprocally in a duplicate ratio of the altitude, that the figure described by projectiles in this region would be an ellipsis, and that all the motions of the heavens were thus to be accounted for; and this he did in such a way as if he had found out all, and knew it most certainly. And upon this information I must now acknowledge in print that I had all from him, and so did nothing myself but drudge in calculating, demonstrating, and writing, upon the inventions of this great man."

VIII.

We now leave Hooke and come to the incidents of 1684.

As Newton observed in the scholium to the fourth proposition of the first book of the *Principia,* Sir Christopher Wren, Hooke, and Halley had each observed that, in the case of the celestial bodies, "if the periodic times are in the sesquiplicate ratio of the radii, and therefore the velocities reciprocally in the subduplicate ratio of the radii, the centripetal forces will be in the duplicate ratio of the radii inversely: and the contrary." The facts were given in a letter from Halley to Newton dated June 29, 1686:[1]

"According to your desire in your former, I waited upon Sir Christopher Wren to inquire of him if he had the first notion of the reciprocal duplicate proportion from Mr. Hooke. His answer was that he himself very many years since had had his thoughts upon the making out of the planets' motions by a composition of a descent towards the

[1] Brewster, *op. cit.*, Vol. I, pp. 293, 296-298; Rouse Ball, *op. cit.*, pp. 25-36, 162-163.

sun and an impressed motion; but that at length he gave over, not finding the means of doing it. Since which time Mr. Hooke had frequently told him that he had done it, and attempted to make it out to him, but that he never satisfied him that his demonstrations were cogent. And this I know to be true, that in January, 1683/4 I, having from the consideration of the sesquialter proportion of Kepler, concluded that the centripetal force decreased in the proportion of the squares of the distances reciprocally, came one Wednesday to town, where I met with Sir Christopher Wren and Mr. Hooke, and, falling into discourse about it, Mr. Hooke affirmed that upon that principle all the laws of the celestial motions were to be demonstrated, and that he himself had done it. I declared the ill success of my attempts; and Sir Christopher, to encourage the inquiry, said that he would give Mr. Hooke or me two months' time to bring him a convincing demonstration thereof, and, besides the honor, he of us that did it should have from him a present of a book of forty shillings. Mr. Hooke then said that he had it, but he would conceal it for some time, that others, trying and failing, might know how to value it when he should make it public. However, I remember Sir Christopher was little satisfied that he could do it, and though Mr. Hooke then promised to show it him, I do not yet find that in that particular he has been as good as his word. The August following, when I did myself the honor to visit you, I learnt the good news that you had brought this demonstration to perfection, and you were pleased to promise me a copy thereof, which, the November following, I received with a great deal of satisfaction from Mr. Paget; and thereupon took another journey down to Cambridge on purpose to confer with you about it, since which time it has been entered upon the register books of the Society. As all this time past Mr. Hooke was acquainted with it, and, according to the philosoph-

ically ambitious temper he is of, he would, had he been master of a like demonstration, no longer have concealed it, the reason he told Sir Christopher and me now ceasing. But now he says that this is but one small part of an excellent system of nature which he has conceived, but has not yet completely made out, so that he thinks not fit to publish one part without the other. But I have plainly told him that unless he produce another differing demonstration and let the world judge of it, neither I nor any one else can believe it."

When in the August of 1684[2] Halley[3] visited Newton, he, without mentioning any of these speculations, "at once indicated the object of his visit by asking Newton what would be the curve described by the planets on the supposition that gravity diminished as the square of the distance. Newton immediately answered, 'an ellipse.' Struck with joy and amazement Halley asked him how he knew it. 'Why,' replied he, 'I have calculated it'; and, being asked for the calculation, he could not find it, but promised to send it to him. After Halley left Cambridge, Newton endeavored to reproduce the calculation, but did not succeed in obtaining the same result. Upon examining carefully his diagram and calculation, he found that in describing an ellipse coarsely with his own hand he had drawn the two axes of the curve instead of two conjugate diameters somewhat inclined to one another. When this mistake was corrected he obtained the result which he had announced to Halley."[4]

Newton sent the propositions, which were presumably on the conservation of areas under a central force, the law

[2] On the origin of the mistake sometimes made of taking 1683 for 1684, see Brewster, *op. cit.*, Vol. I, note on pp. 296-297; Rouse Ball, *op. cit.*, pp. 32-33.

[3] It must be remembered that an immense debt is owing to Edmund Halley both for the unwearied tact which he showed in persuading Newton to overcome his reluctance to publish, and for his generosity in paying for the publication when he could ill afford it (*ibid.*, pp. 67-68).

[4] Brewster, *op. cit.*, p. 297; Rouse Ball, *op. cit.*, p. 26.

of force in a focus under which an ellipse can be described, and the converse on the orbit described by a particle under a central force which varies inversely as the square of the distance,[5] to Halley in November, 1684; and Halley, on his return from his second visit to Newton, gave at the meeting of the Royal Society on Dec. 10, "an account that he had lately seen Mr. Newton at Cambridge, who had showed him a curious treatise, *De motu*; which, upon Mr. Halley's desire, was, he said, promised to be sent to the Society to be entered upon their register. Mr. Halley was desired to put Mr. Newton in mind of his promise for the securing his invention to himself till such time as he could be at leisure to publish it."[6]

Newton seems to have been stimulated by Halley's visit in August to continue his investigations. In the Michaelmas term of 1684 he read, as his professorial lectures, from a manuscript which is still extant and which bears the title *De motu corporum.* Whether this was the "curious tract" seen by Halley, or whether Halley saw the *Propositiones de motu,*[7] which was afterwards registered on the books of the Royal Society, is a question which has been much discussed,[8] but which is unimportant from the point of view of the development of the principles of mechanics. For the fact is that, in the first three lectures, the definitions and laws of motion are given exactly in the form in which they were stated in the *Principia.* Of these lectures it might be said with far more justification than has been said by Rouse Ball[9] of the tract *Propositiones de motu,* that they are "memorable as marking the point at which Newton had arrived about the end of 1684." I will discuss

[5] Rouse Ball, *op. cit.,* pp. 26-27. The propositions are I, XI, and XIII (Cor. I) of the first Book of the *Principia.*

[6] Rouse Ball, *op. cit.,* p. 30.

[7] See Rouse Ball, *op. cit.,* pp. 31, 33-51 (where it is printed).

[8] See *ibid.,* pp. 30-33; Brewster, *op. cit.,* pp. 299-300.

[9] *Op. cit.,* p. 33.

Newton's lectures in the next section; in the following section, the parts of the above tract which relate to the principle and the manuscript drafts of it in the Cambridge University Library will be described.

Here may be put in a small bit of evidence that Newton did not send the tract to Halley in November, but only an informal communication. Newton wrote to Halley on May 27, 1686: "In the papers in your hands there is not one proposition to which he [Hooke] can pretend."[10]

IX.

Newton had been appointed Lucasian Professor in the University of Cambridge in 1669, and first lectured on mechanics in the Michaelmas term of 1684.[1] The manuscript of these lectures is preserved at the University Library in Cambridge[2] in a volume containing the book-plate of King George the First, probably inserted by mistake, as the volume could not have been part of Bishop Moore's library.[3]

The reason of the appearance of King George the First's book-plate in the books from Bishop Moore's library in the University Library of Cambridge is as follows:[4] In 1715 the university sent up a loyal address to King George I on his accession, and the king, as a reward, bought the library of Dr. John Moore (1646-1714, Bishop of Norwich and afterwards of Ely), and presented it to the university. About the same time a troop of horse was quartered at Oxford in consequence of a Jacobite disturbance on the anniversary of the Pretender's birth. Hence

[10] *Ibid.*, p .155.

[1] On these and Netwon's other lectures, see Rouse Ball, *op. cit.*, pp. 27-30.

[2] Class-mark: "Dd. 9. 46." The Contents are described by Edleston (*op. cit.*, pp. xcv-xcvii) and Rouse Ball.

[3] Henry Bradshaw (*Collected Papers of Henry Bradshaw, late Universty Librarian*, Cambridge, 1889, p. 201) wrote that there are no inventories of Bishop Moore's library preserved, not even of the manuscripts.

[4] *In Praise of Cambridge: an Anthology in Prose and Verse*, selected and edited by Sydney Waterlow, London, 1912, pp. 14, 210.

the following epigram by an Oxford wit, probably Dr. Trapp or Thomas Warton:

> "The king observing with judicious eyes,
> The state of both his universities,
> To one he sends a regiment; for why?
> That learned body wanted loyalty.
> To th'other books he gave, as well discerning
> How much that loyal body wanted learning."

Dr. William Browne (1692-1774), according to Mrs. Piozzi, heard Dr. Samuel Johnson quote this, and thereupon composed impromptu:

> "The king to Oxford sent his troop of horse,
> For Tories own no argument but force.
> With equal care, to Cambridge books he sent:
> For Whigs allow no force but argument."

"Mr. Johnson," says Mrs. Piozzi, "did Browne the justice to say it was one of the happiest extemporaneous productions he ever met with; though he once comically confessed that he hated to repeat the wit of a Whig in support of Whiggism."

X.

These lectures contain the definitions, laws of motion, the first section, and the first 35 propositions of the *Principia*. It must be remembered that the third law of motion of the *Principia* is not used until the eleventh section of that work, which deals with the motion of two or more bodies under their mutual attractions, and begins with Proposition LVII. In the tract sent to the Royal Society, there is, as we shall see in the next section, no mention at all of the third law; but there is in one of the unpublished drafts of this manuscript. From another manuscript in the Portsmouth Collection, which has not, I think, been particularly noticed before, there is a statement of the third

law which seems to carry its recognition back to an earlier period of Newton's life.

Brewster[1] merely said of the Royal Society's tract that "it occupies twenty-four octavo pages, and consists of four theorems and seven problems, four of the theorems and four of the problems containing the more important truths which are demonstrated in the second and third sections of the first book of the *Principia*"; and neither by Brewster, Rosenberger,[2] nor by any historian of mechanics or mathematics, so far as I know, is pointed out the fact that the third law of motion appears not at all in the Royal Society's manuscript; or that it appears in a different form to that of the *Principia*, in a manuscript in the Portsmouth Collection written shortly after this.

XI.

In the Royal Society's tract[1] there are three definitions, (centripetal force, force of a body [of inertia], and resistance) and[2] four "Hypotheses":

"1. In the next nine propositions the resistance is to be zero, in the following ones it is to be conjointly as the density of the medium and the velocity;

"2. Every body, by the force implanted in it, moves to infinity uniformly in a straight line unless something outside it prevents it;

"3. A body in a given time, under the joint action of forces, is carried to the same place as by separate forces in successive equal times;

[1] *Op. cit.*, Vol. I, p. 299. Cf. Rosenberger, *op. cit.*, p. 159.

[2] When speaking of the third law of motion on pp 176-177 (*op cit.*).

[1] Reproduced on pp. 35-51 of Rouse Ball's book.

[2] "1. Resistentiam in proximis novem propositionibus nullam esse, in sequentibus esse ut medii densitas et celeritas conjunctim.

"2. Corpus omne sola vi insita uniformiter secundum lineam rectam in infinitum progredi, nisi aliquid extrinsecus impediat.

"3. Corpus in dato tempore, viribus conjunctis, eo ferri quo viribus divisis in temporibus aequalibus successive.

"4. Spatium quod corpus, urgente quacunque vi centripeta, ipso motus initio describit, esse in duplicata ratione temporis" (*ibid.*, p. 36).

"4. The space which a body, being urged by some centripetal force, describes from the same beginning of motion, is in the duplicate ratio of the time."

The propositions correspond[3] to those in the *Principia,* Book I, Propositions 1, 4, 6, 7, 10, 11, 15, 17, 32, and Book II, Propositions 2, 3, and 4, and deal with the motion of particles about fixed centers of force in non-resisting and resisting media. There is nothing corresponding to the third law of motion here.

But there is in the Portsmouth Collection[4] a manuscript draft of the tract, which appears to me to be of later date than the other two. It is somewhat fuller and bears the heading, which perhaps is of a later date than the manuscript and possibly not in Newton's handwriting: *De motu sphaericorum corporum in fluidibus,*[5] and contains a different form of the third law of motion. In this manuscript there are five laws,[6] the term "hypothesis" here and in the subsequent references in the manuscript being crossed out and *lex* written. These are as follows:[7]

"Law 1. A body always proceeds, by the force implanted in it alone, uniformly in a straight line if nothing prevents it;

"Law 2. Change of state of motion or rest is proportional to the impressed force and takes place in the straight line in which that force is impressed;

[3] Cf. *ibid.,* pp. 33-34.

[4] On two other drafts of the tract, see *ibid.,* p. 51.

[5] Reproduced on pp. 51-56 (*ibid.*).

[6] *Ibid.,* p. 52. Cf. the application of the third and fourth laws translated below (from pp. 54-55).

[7] "Lex 1. Sola vi insita corpus uniformiter in linea recta semper pergere si nil impediat.

"Lex 2. Mutationem status movendi vel quiescendi proportionalem esse vi impressae et fieri secundum lineam rectam qua vis illa imprimitur.

"Lex 3. Corporum dato spatio inclusorum eosdem esse motus inter se sive spatium illud quiescat sive moveat id perpetuo et uniformiter in directum absque motu circulari.

"Lex 4. Mutuis corporum actionibus commune centrum gravitatis non mutare statum suum motus vel quietis. Constat ex Lege 3.

"Lex 5. Resistentiam medii esse ut medii illius densitas, et corporis moti sphaerica superficies et velocitas conjunctim" (*ibid.* p. 52).

"Law 3. The motions with respect to one another of bodies included in a given space are the same whether the space is at rest or moves perpetually and uniformly in a straight line without a circular motion;

"Law 4. By the mutual action of bodies the common center of gravity does not change its state of motion or rest. Proved from Law 3.

"Law 5. The resistance of a medium is proportional conjointly to the density of the medium, the spherical surface of the body moved, and the velocity."

At the end of Law 4, after "Constat ex," apparently "ex lege 3" was written, crossed out, and then rewritten. Law 3 is the same as Cor. V and Law 4 as Cor. IV to the Laws of Motion of the *Principia*.

In this manuscript there is an addition[8] of which this is a translation:

"The whole remaining space of the planetary heavens either is at rest (as is commonly believed) or moves uniformly in a straight line, and therefore the common center of gravity of the planets (by Law 4) either is at rest or moves with it. In both cases the motions of the planets relative to one another take place (by Law 3) in the same manner, and their common center of gravity is at rest with respect to the whole of space and ought therefore to be considered as the motionless center of the whole planetary system. Hence, in truth, the Copernican system is proved *a priori*. For if the common center of gravity be computed for any position of the planets, it will either fall in the body of the sun or will always be near it. Owing to this deviation of the sun from the center of gravity, it comes about that the centripetal force does not always tend towards the motionless center, and consequently that the planets neither move exactly in ellipses nor revolve twice in the same orbit. There are as many orbits of each planet as there are rev-

[8] *Ibid.*, pp. 54-55.

olutions, as is the case with the moon's motion, and each several orbit depends on the conjoint motions of all the planets, to say nothing of the mutual actions which they all exert on one another. But to consider at once so many causes of motions and to define the motions themselves by exact laws admitting of convenient calculation surpasses, if I mistake not, the power of any human ingenuity. Neglecting these details, the orbit will be simple, and, as the mean of all the errors, will be the ellipse of which I have treated already. If anyone should try to determine this ellipse from three observations by a trigonometrical computation (as is usual), he will have approached the matter without sufficient caution. The observations will participate in the minute irregularities of the motions which are here neglected, and will therefore cause the ellipse to deviate a little from its just magnitude and position (which ought to be the mean of all the errors), and will give as many ellipses discrepant with one another as sets of three observations are admitted. Therefore as many observations as possible ought to be conjoined and compared by one operation, that these operations may mutually correct one another and exhibit the ellipse as a mean in position and magnitude."

XII.

We will now turn our attention to the other manuscripts of Newton's preserved in the University Library of Cambridge.

Among the early papers by Newton (holograph) in Section I, Division I, of the Portsmouth Collection[1] are:

3. A tract in English written in 1666 and entitled: *To Resolve Problems by Motion.* Also short tracts entitled:

De solutione problematum per motum;

[1] *Portsmouth Catalogue,* p. 1. The numbers 3-5 refer to items in this *Catalogue.*

De gravitate conicarum;
Problems of Curves.

4. *Calculation of the Area of the Hyperbola.*[2]

5. *On the Laws of Motion*;
On the Laws of Reflection;
On Motion in a Cycloid.

The tract *To Resolve Problems by Motion* is dated—apparently by Newton at a later date—October, 1666, and is concerned, not with mechanics, but with the use of the conception of motion in geometry.

In the margins of the tract *On the Laws of Motion* in No. 5 are:

1. Of place, motion, velocity and force;
2. With what velocity a body moves several ways at once;
3. How two progressive motions are joined into one [Parallelogram of motions];
4. Of centers and axes of motion and the motion of those centers.
5. Of circular motion and velocity about those axes;
6. With what velocity a body circulates about several axes at once;
7. How two circular motions are joined into one;
8. In what cases a circulating body perseveres in the same state and in what it doth not.

How bodies are reflected.

9. Some names and letters defined;
10. The Rule for Reflection;
11. The Conclusion;
12. In what method the precedent rules must be used.

The tract concludes with "Some observations about motion." In the first section occur the words:

"Which motion is done with more or less velocity ac-

[2] This was an early calculation of Newton's performed at Boothby in Lincolnshire.

cordingly as it is done through more or less space in equal times or through equal spaces in more or less time. But the motion itself and the force to persevere to the motion is more or less accordingly as the factors of the body's bulk into its velocity is more or less. And that force is equivalent to that motion it is able to beget or destroy."

Again, the fourth section is:

"In every body there is a certain point, called its center of motion, about which if the body be any way circulated, the endeavors of its points every way from the center are exactly counterpoised by opposite endeavors. And the progressive motion of the body is the same with the motion of this its center which always moves in a straight line and uniformly with other bodies. And so doth the common center of two bodies, which is found by dividing the distance between their proper centers in reciprocal proportion to their bulk. And so the common center of three or more bodies, etc. And all the lines passing through these centers of motion are axes of motion."

The tract *On the Laws of Reflection* begins in the same way as above.

In Section VIII, No. 5,[3] there is the beginning of "The Elements of Mechanicks." This tract begins as follows:

"1. All bodies continue perpetually in their state of resting or moving in right lines unless disturbed by any force, and, when disturbed, the changes of these states are proportional to the force disturbing them. And if this change and the antecedent motion of the body be represented in situation and quantity by the sides of a parallelogram, the motion arising from them both shall be represented by the diagonal of that parallelogram.

"2. The actions of two bodies upon one another are always equal and directly contrary, and the resiliation of clashing bodies is as their springiness, and the force of a

[3] *Portsmouth Catalogue*, p. 49.

globular body upon a resting plane is as the part of its velocity which is perpendicular to the plane.

"3. The forces with which the parts of one and the same engine move at one and the same time are reciprocally proportional to their velocities.

"4. In a system of bodies moving variously amongst one another and acting upon one another by any other bodies, the common center of gravity of them all either rests perpetually or moves uniformly in a right line, and, whether it rests or moves, the motions of the bodies amongst one another are the same.

"5. Falling bodies describe spaces proportional to the squares of the times, and so do projectiles by their motions of ascent and descent, but their horizontal motions are uniform and with both motions together they describe parabolas, and water spouts up in a parabolic figure after the manner of projectiles."

These extracts show that Newton's conception of mass as quantity of matter dated from his early days. Indeed, it is quite likely that this conception was possessed by others[4] than Newton before Newton's time, but in an unformulated fashion. If we examine the basis of this conception, we see that the conception rests upon the implicit postulate of the sameness, in essentials, of all matter.

[4] I am thinking more particularly of Wallis. Besides the reference to him in "Robert Hooke as a Precursor of Newton" (*Monist*, July, 1913), cf. the following passage from Edleston, *op. cit.*, pp. 300-301, from a letter which Wallis wrote to Newton on April 10, 1695: "I understood you are now about adjusting the moon's motions; and, amongst the rest, take notice of that of the *common center of gravity* of the earth and moon as a conjunct body (a notion which, I think, was first started by me, in my Discourse of the Flux and Reflux of the Sea). And it must needs be of a like consideration in that of Jupiter with his Satellites, and of Saturn with his. (And I wonder we have not yet heard of any about the moon.) But, Saturn and Jupiter being so far off, the effects thereof are less observable by us than that of the moon. My advice upon the whole, is, that you would not be too slow in publishing what you do." In Siegmund Günther's article "Histoire des origines de la loi Newtonienne de la gravitation" (Bibliothèque du Congrès internationale de Philosophie, III: *Logique et histoire des sciences*, Paris, 1901, pp. 49-75), which is very rich in references, there is on p. 63 a statement that Fermat was acquainted with the principle of the equivalence of action and reaction, and also with the fact that a material point is more feebly attracted inside a sphere than outside.

There seems to be a natural bent of the human mind to start from, or arrive at, this postulate. Descartes, who had the philosopher's quality of being conscious of some at least of the postulates on which his system was founded, started from the hypothesis of a homogeneous *plenum,* and his example is being constantly followed by those physicists of even our own day who are unacquainted with the history of thought. Hooke, as we have seen, kept the *plenum* but believed in qualitative differences in matter. Newton seems to have believed in the ultimate sameness of constitution of matter, and hence must have early freed himself from Cartesian opinions, if he ever held them. He seems to have been a follower of Robert Boyle's "corpuscular philosophy."[5]

XIII.

In order to compare these earlier statements of Newton's fundamental principles of dynamics with those in his *Principia* of 1687, it will be as well to consult the translation by Andrew Motte[1] of Newton's final statement of the "Axioms or Laws of Motion."

I will only make two observations on this later form of Newton's Laws of Motion.

In that manuscript of Newton's which is the second dealt with in §XI above, what is there called "Law 4" is stated to be proved by "Law 3." Now, "Law 3" is the same as the fifth corollary to the Laws of Motion of the

[5] On Descartes's physical theory and for a criticism of it, see Kurd Lasswitz, *Geschichte der Atomistik vom Mittelalter bis Newton,* Vol. II, Hamburg and Leipsic, 1890, pp. 55-126. By "density" (*soliditas*) Descartes (*Principia,* 1644, III, 121) understood the quantity (*quantitas*) of his "third element"—which forms the enveloping crust of the planets—as compared with its total magnitude (*moles*) and surface (see Lasswitz, *op. cit.,* pp. 70-72). On Boyle's corpuscular theory, see *ibid.,* pp. 261-293. On Huygens's work, see *ibid.,* pp. 341-397. Finally, on Newton's physics, see *ibid.,* pp. 555-580.

[1] *The Mathematical Principles of Natural Philosophy*; 2 vols. London, 1729. The laws of motion are on pp. 19-40 of the first volume. American editions, New York, 1848, 1850.

Principia: "The motions of bodies included in a given space are the same among themselves whether that space is at rest or moves uniformly forwards in a right line without any circular motion." Newton deduced this corollary from the second law of the *Principia*. "Law 4" of the manuscript is the same as the fourth corollary to the Laws of Motion of the *Principia*: "The common center of gravity of two or more bodies does not alter its state of motion or rest by the actions of the bodies among themselves; and therefore the common center of gravity of all bodies acting upon each other (excluding outward actions and impediments) is either at rest or moves uniformly in a right line." This corollary is a simple deduction from the third Law of the *Principia*, and cannot, as Newton appeared to think in the manuscript referred to, be deduced from the "Law 3" of that manuscript.

XIV.

In the second place, Newton had a most interesting passage in the scholium to the Laws of Motion. After showing that "the third law, so far as it regards percussions and reflexions, is proved by a theory exactly agreeing with experience," he proceeded as follows:

"In attractions I briefly demonstrate the thing after this manner. Suppose an obstacle is interposed to hinder the congress of any two bodies A, B, mutually attracting each other, then if either body, as A, is more attracted towards the other body B, than that other body B is towards the first body A, the obstacle will be more strongly urged by the pressure of the body A than by the pressure of the body B, and therefore will not remain in equilibrium: but the stronger pressure will prevail, and will make the system of the two bodies, together with the obstacle, move directly towards the side on which B lies; and in free space to go forward to infinity with a motion perpetually acceler-

ated—which is absurd, and contrary to the first law. For, by the first law, the system ought to persevere in its state of rest or of uniform motion forwards in a right line; and therefore the bodies must equally press the obstacle, and be equally attracted one by the other. I made the experiment on the loadstone and iron. If these are placed apart in proper vessels and made to float by one another in standing water, neither of them will propel the other, but by being equally attracted they will sustain each other's pressure and rest at last in equilibrium.

"So[1] the gravitation between the earth and its parts, is mutual. Let the Earth FI be cut by any plane EG into two parts EGF and EGI: their weights one towards the other will be mutually equal. For if, by another plane HK, parallel to the former EG, the greater part EGI is cut into two parts EGKH and HKI, whereof HKI is equal to the part EFG first cut off: it is evident that the middle part EGKH will have no propensity by its proper weight towards either side, but will hang as it were at rest and in equilibrium between both. But the one extreme part HKI will with its whole weight bear upon and press the middle part towards the other extreme part EGF; and therefore the force with which EGI, the sum of the parts HKI and EGKH, tends towards the third part EGF, is equal to the weight of the part HKI, that is, to the weight of the third part EGF. And therefore the weights of the two parts EGI and EGF, one towards the other, are equal, as I was to prove. And indeed if those weights were not equal, since the whole earth floats in the non-resisting ether, it would give way to the greater weight, and, retiring from it, would be carried off to infinity."

This passage is particularly interesting because it contains the same form of argument—the excluded *perpetuum*

[1] This paragraph first appeared in the second edition (1713) of the *Principia.*

mobile—that, as Mach[2] has shown, Stevinus, Galileo, Huygens, Torricelli, John Bernoulli, Lagrange, Sadi Carnot, Julius Robert Mayer, Franz Neumann, and Helmholtz used as the foundation both of mechanics and of other parts of physics. That this remark of Newton's was not referred to by Mach makes it all the more necessary to refer to it here.

Further to illustrate this point, we will consider a part of the correspondence of Cotes and Newton, when Cotes was preparing the second edition of the *Principia*.[3]

Cotes, when giving Newton, in a letter of March 18, 1713, an account of the Preface he meant to write, commented as follows on Prop. V of Book III:[4]

"But, in the first corollary of this fifth proposition, I meet with a difficulty; it lies in these words: *Et cum attractio omnis mutua sit.* I am persuaded that they are then true when the attraction may properly be so called, otherwise they may be false. You will understand my meaning by an example. Suppose two globes A and B placed at a distance from each other upon a table, and that, whilst the globe A remains at rest, the globe B is moved towards it by an invisible hand; a bystander, who observes this motion but not the cause of it, will say that the globe B does certainly tend to the center of globe A, and thereupon he may call the force of the invisible hand the centripetal

[2] See the English translation of his publication of 1872. This translation is entitled: *History and Root of the Principle of the Conservation of Energy* (Chicago: Open Court Publishing Co., 1911).

[3] In all of these letters, since the interest is scientific rather than literary, I have modernized dates and spelling, and translated Latin sentences, for the convenience in reading and printing.

[4] Edleston, *op. cit.*, pp. 152-153, The proposition referred to is: "That the circumjovial planets gravitate towards Jupiter, the circumsaturnal towards Saturn, the circumsolar towards the sun; and, by the forces of their gravity, are drawn off from rectilinear motions and retained in curvilinear orbits." The first corollary is: "There is therefore a power of gravity tending to all the planets. For doubtless Venus, Mercury, and the rest are bodies of the same sort as Jupiter and Saturn. And, since all attraction (by the third law) is mutual, Jupiter will therefore gravitate towards all his own satellites, Saturn towards his, the earth towards the moon, and the sun towards all the primary planets."

force of B and the attraction of A, since the effect appears the same as if it did truly proceed from a proper and real attraction of A. But then I think he cannot, by virtue of the axiom *Attractio omnis mutua est*, conclude, contrary to his sense and observation, that the globe A does also move towards the globe B and will meet it at the common center of gravity of both bodies. This is what stops me in the train of reasoning by which I would make out, as I said, in a popular way, your seventh proposition of the third book. I shall be glad to have your resolution of the difficulty, for such I take it to be. If it appears so to you also, I think it should be obviated in the last sheet of your book, which is not yet printed off, or by an Addendum to be printed with the Errata table. For, until this objection be cleared, I would not undertake to answer any one who should assert that you do *hypothesim fingere*. I think you seem tacitly to make this supposition that the attractive force resides in the central body."

On March 28 Newton replied:[5]

"The difficulty you mention, which lies in these words: '*Et cum attractio omnis mutua sit,*' is removed by considering that, as in geometry the word 'hypothesis' is not taken in so large a sense as to include the axioms and postulates, so in experimental philosophy it is not to be taken in so large a sense as to include the first principles or axioms which I call the Laws of Motion. These principles are deduced from phenomena and made general by induction, which is the highest evidence that a proposition can have in this philosophy. And the word 'hypothesis' is here used by me to signify only such a proposition as is not a phenomenon nor deduced from any phenomena, but assumed or supposed without any experimental proof. Now the mutual and mutually equal attraction of bodies is a

[5] *Ibid.*, pp. 154-155.

branch of the third Law of Motion, and how this branch is deduced from phenomena you may see in the end of the corollaries of the Laws of Motion. If a body attracts another body contiguous to it and is not mutually attracted by the other, the attracted body will drive the other before it and both will go away together with an accelerated motion to infinity, as it were by a self-moving principle, contrary to the first Law of Motion, whereas there is no such phenomenon in all nature.

"At the end of the last paragraph but two now ready to be printed off,[6] I desire you to add after the words: 'a God without dominion, providence, and final causes, is nothing else but fate and nature' these words: 'And thus much concerning God; to discourse of whom from the appearances of things does certainly belong to natural philosophy.'

"And, for preventing exceptions against the use of the word 'hypothesis,' I desire you to conclude the next paragraph in this manner: 'For whatever is not deduced from the phenomena, is to be called a hypothesis; and hypotheses, whether metaphysical or physical, whether of occult qualities or mechanical, have no place in experimental philosophy. In this philosophy particular propositions are inferred from the phenomena, and afterwards rendered general by induction. Thus it was that the impenetrability, the mobility, and the impulsive force of bodies, and the laws of motion and of gravitation, were discovered. And to us it is enough that gravity does really exist, and act according to the laws which we have explained, and abundantly serves to account for all the motions of the celestial bodies and of our sea.'"

[6] This is in the "General Scholium" at the end of the *Principia*.

XV.

In his *Principia,* Newton[1] defined "quantity of matter" as the product of volume and density. He gave no further explanation of the conception of density; but from what he said later on it appears that he supposed the smallest particles of matter to be equally dense and simply put the density proportional to the number of these particles in a given space.[2]

When giving an account of the eleventh section of the first book of the *Principia,* Rosenberger[3] remarked: "Since all the corpuscles of which bodies consist contain equal quantities of matter, and since all attractions are wholly due to matter, all corpuscles exert equal forces outwards. The total force of a body is thus the sum of the forces of the corpuscles, the action of a body outwards must, without exception, be proportional to the number of its corpuscles, and the weight of a body gives a sure measure of its mass. This idea of a body as a system of corpuscles whose unity only becomes evident with bodies that are very distant from one another, forms the transition from the mechanics of points to the mechanics of systems of points or physical bodies. The indication of this transition is, as is always the case with Newton, very slight. 'It is reasonable to suppose,' said he in the scholium at the end of the eleventh section, 'that forces which are directed to bodies should depend upon the nature and quantity of those bodies, as we see they do in magnetical experiments. And when such cases occur, we are to calculate the attractions of the bodies by assigning to each of their particles its proper force, and then collecting the sum of them all.' "

[1] Book I, Definition I. "It is this quantity that I mean hereafter everywhere under the name of body or mass."

[2] Rosenberger, *op. cit.,* p. 173.

[3] *Ibid.,* p. 192. It must be remembered that the conception of mass and the third law of motion were first used in this eleventh section, which deals with the motions of bodies tending to each other with centripetal forces.

The sixth proposition of the third book is: "That all bodies gravitate towards every planet; and that the weights of bodies towards any planet at equal distances from the center of the planet are proportional to the quantities of matter which they severally contain." To this proposition, the second corollary was: "Universally, all bodies about the earth gravitate towards the earth, and the weights of all bodies at equal distances from the earth's center are as the quantities of matter which they severally contain. This is the quality of all bodies within the reach of our experiments, and therefore, by the third Rule for Philosophizing, is to be affirmed of all bodies whatsoever." To this, Rosenberger[4] added the remark: "For the effect of the whole body is equal to the sum of the effects of its single particles, and therefore, if the particles are all equal, is proportional to the number of the particles or the mass." However, it must be emphasized that Newton nowhere stated explicitly that the mass was proportional to the number of particles. That he thought so, there can, I think, be little doubt.

In the third rule of the *regulae philosophandi* at the beginning of his third book,—the rule, namely, that: "The qualities of bodies, which admit neither intension nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever,"—Newton included among the qualities which can neither be increased nor diminished: extension, hardness, impenetrability, mobility, and inertia, and remarked: "And, because the hardness of the whole arises from the hardness of the parts, we therefore justly infer the hardness of the undivided particles not only of the bodies we feel but of all others.... We conclude the least particles of all bodies to be also all extended, hard, impenetrable, mobile, and en-

[4] *Op. cit.*, p. 214.

dowed with their proper forces of inertia. And this is the foundation of all philosophy. Moreover, that the divided but contiguous particles of bodies may be separated from one another, is matter of observation; and, in the particles that remain undivided, our minds are able to distinguish yet lesser parts, as is mathematically demonstrated. But whether the parts so distinguished, and not yet divided, may, by the powers of nature, be actually divided and separated from one another, we cannot certainly determine. Yet, had we the proof of but one experiment, that any undivided particle, in breaking a hard and solid body, suffered a division, we might, by virtue of this rule, conclude that the undivided as well as the divided particles may be divided and actually separated to infinity."

The second corollary to the sixth proposition went on:

"If the ether, or any other body, were either altogether devoid of gravity or were to gravitate less in proportion to its quantity of matter, then, because, according[5] to Aristotle, Descartes, and others, there is no difference between that and other bodies but in the mere form of matter, it might, by a successive change from form to form, be changed at last into a body of the same condition as those which gravitate most in proportion to their quantity of matter; and, on the other hand, the heaviest bodies, acquiring the first form of that body, might by degrees quite lose their gravity. And therefore the weights would depend upon the forms of bodies, and might be changed with those forms, contrary to what was proved in the preceding [the first] corollary."

The third corollary will occupy us later, in connection with some of the correspondence between Cotes and Newton. The fourth corollary was: "If all the solid particles of all bodies are of the same density and cannot be rarefied

[5] This and the five following words were first added in the second edition of the *Principia*.

without pores, a void space or vaccum must be granted. By bodies of the same density I mean those whose forces of inertia are in the proportion of their bulks." Now, Rosenberger[6] went rather beyond the facts and remarked: "Newton therefore, in a fourth corollary stated that the solid particles of all bodies are equally dense and that bodies of different density only differ by the magnitude and quantity of their pores."

In the April of 1686, Halley[7] announced the appearance of Newton's *Principia* in an essay which appears to have been inspired by Newton and which, as Rosenberger[8] has remarked, "contains in short indications almost all the foundations of Newton's natural philosophy. Only one principle is still lacking, and that is the idea of molecular gravitation or the composition of the gravitation of bodies out of that of their smallest particles. Everywhere, Halley only speaks of the tendency of the single particles of the body towards a point inside the body—the center of gravitation—, but does not remark that this center is obtained by summation of the effects of all the particles, and that the center of force is only a mathematical fiction. Indeed, he even indicates that the Creator might have ordained this center to be anywhere in bodies, and this—so at least it appears to me—directly contradicts the idea of a molecular gravitation. However, it cannot be decided with certainty whether or no Newton himself, at the time at which Halley drew up his memoir, had formed the idea of molecular attraction and had merely not progressed with it so far that he could communicate it to others; or whether or no Newton had not then grasped the thoughts about molecular forces, and only arrived at this important notion after his communications to Halley. From the *Principia* of 1687, we can conclude that the idea of molecular gravitation together

[6] *Op. cit.*, p. 215.
[7] Cf. *ibid.*, p. 260, and Rouse Ball, *op. cit.*, p. 62.
[8] *Op. cit.*, p. 263

with the conceptions of mass, developed with Newton at a fairly late stage—when, in fact, he was busied with the elaboration of the attraction of extended bodies. Still, it is not very likely that this development was still uncompleted at the time of Halley's announcement."

On this, we may again remark that it is now definitely established that Newton did not discover the theorems on the attraction of spherical bodies until 1685, and apparently did not mention them to Halley until the letter of June 20, 1686, an extract from which is given above. On the other hand, the Newtonian conception of mass, as we have seen from Newton's early and previously unpublished manuscripts, was of much earlier growth. It is probable that Newton made then what seems now to be the obvious step —the way for which was amply prepared by Descartes— of considering the ultimate particles of all bodies to be of the same density, and all the differences of bodies to arise solely from the number of these particles in a given space; and it is not unlikely, as we saw above, that Newton early reached the idea of universal gravitation—of attractions between particles, which vary inversely as the squares of the distances and directly as the masses. If this be so, we must admit that Newton's physical views were, in essentials, completed at an early date, and that the subsequent development of his "philosophy" was preeminently of a mathematical character. Of course, the mathematical work enabled precision and a most attractive appearance of completeness to be given to these physical views. In particular, the purely mathematical determination of the attractions of spherical bodies seems to have played a very important part in this respect, as in others. I cannot, then, agree with Rosenberger as to the comparatively late growth of Newton's chief physical ideas. On another occasion I will trace the fortunes of Newton's views on the ether and on gravitation as an essential property of matter, and will

examine Rosenberger's opinions on these subjects. However, it seems to me that Rosenberger has correctly grasped the gist of the Newtonian conception of mass, though his methods of quotation are by no means always unprejudiced. It is important to try to get at Newton's exact meaning, for his notions about mass, ether, and whether or no gravitation is an essential property of matter, were never expressed without caution, which is doubtless commendable, and ambiguity, which is certainly not.

XVI.

Mechanical ideas were applied to celestial events, and not only to terrestrial events before Newton's time. Newton, of course, was the first to carry out this application in a thoroughly scientific manner, but good work in this direction had been done by Descartes, Wallis, Wren, Hooke, Halley, and others. With this extension of ideas came the idea of one and the same body—involving therefore something constant—having different weights according to its positions in space.[1] Mach referred with approval to some of Rosenberger's[2] remarks on the Newtonian conception of mass. "It should be observed," said Mach,[3] "that the notion of mass as quantity of matter was psychologically a very natural conception for Newton, with his peculiar development. Critical inquiries as to the origin of the concept of matter could not possibly be expected of a scientist in Newton's day. The concept developed quite instinctively; it is discovered as a datum perfectly complete, and is adopted with absolute ingenuousness. The same is the case with the concept of force. But force appears conjoined with matter. And, inasmuch as Newton invested all material particles with precisely identical gravitational forces, inasmuch as he regarded the forces exerted by the

[1] Cf. Mach, Mechanics, p. 192. Cf. also pp. 194-195, 216-222, 536-537, 558-560 for a criticism of the Newtonian conception of mass.

[2] *Op. cit.*, p. 192. [3] *Op. cit.*, p. 536.

heavenly bodies on one another as the sum of the forces of the individual particles composing them, naturally these forces appear to be inseparably conjoined with the quantity of matter."

On the enumeration of the ultimate particles to get the measure of mass, Mach[4] remarked: "We do not find the expression 'quantity of matter' adapted to explain and elucidate the concept of mass, since that expression itself is not possessed of the requisite clearness. And this is so, though we go back, as many authors have done, to an enumeration of the hypothetical atoms. We only complicate, in so doing, indefensible conceptions. If we place together a number of equal, chemically homogeneous bodies, we can, it may be granted, connect some clear idea with 'quantity of matter,' and we perceive also that the resistance the bodies offer to motion increases with this quantity. But the moment we suppose chemical heterogeneity, the assumption that there is still something that is measurable by the same standard, which something we call quantity of matter, may be suggested by mechanical experiences, but is an assumption nevertheless that needs to be justified." It must be remarked that Newton himself appears to be one of those authors referred to by Mach;[5] and that the Newtonian conception, involving as it does the hypothesis of the sameness in constitution of the ultimate particles of bodies which are chemically heterogeneous, is perfectly clear: the only defect is that it rests on mere hypothesis, which can be neither proved nor disproved. Indeed, it seems that Newton's boast—or expression of caution—*hypotheses non fingo* only applied to such hypotheses as he consciously and explicitly made.

PHILIP E. B. JOURDAIN.

CAMBRIDGE, ENGLAND.

[4] *Ibid.*, pp. 216-217.

[5] Heinrich Hertz, in his well-known work of 1894 on the principles of mechanics, also defined mass as the number of particles.

THE DEVELOPMENT OF MAHAYANA BUDDHISM.

EUROPEAN Buddhist scholars are wont to divide Buddhism into two schools, Northern and Southern. By Southern Buddhism they understand that form which prevails mostly in Ceylon, Burma, and Siam; while Tibetan Lamaism, and Chinese, Korean, and Japanese Buddhism they consider as belonging to the Northern school. This geographical division, however, does not seem to be quite correct and justifiable; for we know that the Buddhism of Tibet is as different from the Buddhism of Japan as the latter is from that of Ceylon or Burma, not only in some of its teachings but principally in its practical aspects. Take, for instance, the Chinese or Japanese Zen sect or the sect of the Pure Land, and compare it to Tibetan Buddhism as it is known to us to-day, and we shall find that the difference between the two is wider perhaps than that between the so-called Southern Buddhism and the Japanese Buddhist sect called Risshu or Vinaya sect.

A better way of classifying the different schools of Buddhism is to divide them into the Buddhism of Arhats and the Buddhism of Bodhisatvas; understanding by the former that Buddhism whose ideal attainment is Arhatship, and by the Buddhism of Bodhisatvas that system of Buddhist teachings which makes the conception of Bodhisatvahood its most salient feature. Or we may retain the old way of classifying the followers of the Buddha into two groups: the Mahâsanghîka and the Sthâvira. Or,

further, we can even invent a new method of division, and call one the progressives and the other the conservatives.

Taking all in all, however, it seems to me that the division of Mahâyâna and Hînayâna Buddhism is preferable to all the rest from the point of view of our knowledge of Buddhism. Of course, this way of dividing Buddhism has its historical odium, which is most desirable for modern scholars of Buddhism to avoid. Except for this latter objection, the term "Mahâyâna" is comprehensive and definite enough to include all those schools of Buddhism in which the ideal of Bodhisatvahood is upheld in preference to the attainment of Arhatship, and whose geographical distribution covers not only the northern parts of India but east of them as well. Let us here, therefore, use the term "Mahâyâna" more for the sake of convenience than anything else, until we shall have studied Buddhism in all its diverse aspects, historic, dogmatic, and ritualistic, when we shall be able to understand Buddhism far better than we do now.

The object of my present article is to expound briefly what in my view constitutes the essential characteristics of Mahâyâna Buddhism in contradistinction to Hînayâna Buddhism.

The character of Mahâyâna Buddhism can be expressed in the one word, speculative. Buddhism generally teaches three forms of discipline: moral (*çîla*), contemplative (*dhyâna*), and intellectual (*prajñâ*); and of these the last seems to have been particularly emphasized by the Mahâyâna Buddhists, while the moral discipline has become the chief feature of Southern Buddhism, so called,—in fact, to such an extent that most Western scholars of Buddhism, whose principal source of information is the Pâli *Tipitaka,* are apt to take Buddhism for no more nor less than a system of ethical culture, which, therefore, cannot be called a religion in the same sense as is Christianity. While the

Buddha apparently taught a well-balanced practice of *çîla, dhyâna,* and *prajñâ,* his followers became one-sided as has been also generally the case with other religious systems, and emphasized one aspect at the expense of the others. The Mahâyâna in one sense can be said to have gone too far in its speculative flight, almost to the point of forgetting its ethical side, while the Hînayâna adherents have been so extremely conservative as to refuse to adapt themselves to an ever-changing environment. However this may be, a practical reformer of Buddhism to-day would do well if he endeavored to restore the three forms of discipline each in its proper bearings and thereby to manifest more perfectly the original spirit of the founder of Buddhism.

This one-sided tendency and the development of the two schools of Buddhism can also be seen in their respective history. In Ceylon, there has been practically but one school ever since the introduction of Buddhism there. The Singhalese Buddhists have had one code of morality, the Vinaya, which is recorded in detail in their scriptures, and which, being so very explicit in its enunciation that even the uncultured could comprehend it readily, does not allow of very widely divergent interpretations. Accordingly there were few chances for dissension. The Vinaya as it is practised to-day in Ceylon has not changed even in its details since the day of its first promulgation there. In this respect we can say that Hînayâna Buddhism faithfully preserves the practical form of Buddhist moral culture as it developed during the time that elapsed after the decease of the Buddha down to the despatch of the Asoka missionaries to this district. I emphasize this latter point; for it is quite reasonable to suppose, and the supposition is justified by the records in our possession, that Buddhism began to grow in its diverse aspects soon after the death of the Buddha.

History, however, shows us a very different state of affairs among the Mahâyâna followers. Into how many schools did the Mahâyâna divide itself! And how vehemently did each school defend its own doctrine against the others! While the Hînayâna Buddhists evidently kept quiet, the Mahâyâna spoke disparagingly of their rival believers, and this was altogether unworthy of their professed liberalism. In fact, it was through their self-conceit that they came to designate themselves as Mahâyâna Buddhists, followers of the Great Vehicle of Salvation, which had in view the discrediting of their conservative brethren in the faith. This spirit of self-exaltation was exhibited not only against the more orthodox ethical adherents of Buddhism, but also among themselves, as witness the famous founder of the Nichiren or the Pundarîka sect of Buddhism in Japan. His denunciation of the other Buddhist sects then existent in Japan was so strong and abusive that the authorities of the time thought it politic to get rid of him quietly, though I must add that his prosecution was not solely due to religious reasons.

This struggle and fighting, however, was quite in accord with the somewhat one-sided development of the Mahâyâna in the direction of speculative philosophy. Intellect is always inclined to dissent, to quarrel, to become self-conceited. The existence of ten or twelve sects of Japanese Buddhism was the inevitable result of the general movement of the speculative Mahâyâna. Of course, the other phases of Buddhism were not altogether forgotten; for the practice of *dhyâna* (meditation) is still in evidence,—indeed there is one sect in Japan and China bearing its very name and exercising much influence, especially among the educated classes. However this may be, the fact remains that the Mahâyâna is a development of one side—the intellectual, speculative, philosophical side—of Buddhism, while the Hînayâna preserves the ethical side of Buddhism

comparatively in its pure and primitive form. To realize the perfect type of Buddhism, the threefold treasure, Triratna, must be equally developed; the Buddha, the Dharma and the Sangha must stand side by side imbued with the same spirit as when they were first established, whatever outward transformation they might have undergone according to varying circumstances. If the Hînayâna is said to have the Sangha in its model form, the Mahâyâna may be considered to have fully developed the Dharma, that is, the religio-philosophical signification of Buddhism; while both schools claim the Buddha as their common founder. The problem that faces faithful Buddhists at present is how best to effect a complete reconciliation of the moral discipline of Hînayâna with the speculations of Mahâyâna.

Now let us see how Mahâyâna Buddhism has developed its speculative course as compared to the Hînayâna, and I will first discuss the doctrine of *anâtman,* or non-ego. This is considered one of the most important and characteristic features of Buddhism, and justly so, because both the Hînayâna and the Mahâyâna uphold this as essential to their *raison d'être.* However, the Hînayâna school seems to have remained almost too faithful, as it were, to the doctrine; it has not gone beyond its negative statement; it has not carried out its logical consequence to the utmost limits. On the other hand the Mahâyâna has not only extended the theory from its subjective significance to the objective world, but has also boldly developed the positive conclusion implied in it. I do not mean that the Hînayâna has none of these tendencies as shown by the Mahâyâna; in fact, it seems to contain everything Mahâyânistic in germinal form. What most eminently distinguishes the Mahâyâna school in this connection is that it makes the most explicit, manifest, unequivocal, and fearless assertions on these religio-philosophical questions which deeply concern the human heart.

With regard to the non-ego theory, the Mahâyâna followers assert that there is no *âtman* or ego-soul not only in its psychological signification, but in its objective sense. That is to say, they deny with the Hînayâna followers that there is any such thing as an ego-entity, a concrete, simple, ultimate, and independent unit, behind our consciousness; but they go still further and declare that this objective world too has no *âtman*, no ego, no personal creator, no Ishvâra, who works and enjoys his absolute transcendence behind the eternal concatenation of cause and effect. This is technically known as a double negation of the subjective and the objective world, and it is on this account that the Mahâyâna school has often been called, though unjustifiably and quite incorrectly, nihilism or *çûnyavâdin*.

In this connection, it may be of interest to quote a Western Buddhist scholar's opinion of Buddhism as typical of a prejudiced and uncritical judge. Eitel, a noted scholar of Chinese Buddhism, speaks thus of the Buddhist doctrine of Nirvana in his *Three Lectures on Buddhism*, which were delivered in Union Church, Hongkong, 1870-71: "Nirvâna is to them [the Buddhists] a state of which nothing could be said, to which no attributes can be given; it is altogether an abstract, devoid alike of all positive and all negative qualities. What shall we say of such empty, useless speculations, such sickly, dead words, whose fruitless sophistry offers to that natural yearning of the human heart after an eternal rest nothing better than a philosophical myth? It is but natural that a religion which started with moral and intellectual bankruptcy should end in moral and intellectual suicide" (p. 21, column 2).

As a matter of fact, the Mahâyâna followers do not regard negation as the ultimate goal of their speculations. With them negation is but a road to reach a higher form of affirmation; for they are aware of the fact that the

human mind lives in affirmation and not in negation. Any critic of Mahâyâna philosophy, who with sympathetic insight penetrates deep enough into its heart, would readily find that behind a series of negations offered by the Mahâyâna thinkers there is really the assertion of a higher truth, which, owing to the limitations of the human intellect, cannot be presented by any other means than by negation. It is not due to sophistry nor mere abstraction that the Buddhists sometimes appear to delight in a negative statement of truth. They are most earnestly religious; they know that the deepest religious truth cannot be presented in a stereotyped philosophical formula. Only those who are short-sighted timidly stop at the negation and refuse to go beyond. If they thus misjudge the significance of Mahâyâna Buddhism, the fault is on their own side.

What, then, is that positive something offered by the Mahâyâna scholars as the logical conclusion of the theory of non-atman? It is generally designated as *tatvâ* or suchness. This is a philosophical term, and when its religious importance is emphasized it is called *dharmakâya*.[1] In this conception of suchness, or *dharmakâya,* they find the highest possible affirmation which is reached after a series of negations and which unifies all forms of contradiction, psychological, ethical, and ontological. Ashvagosha, one of the greatest early Buddhist philosophers in India, says in his *Awakening of Faith in the Mahâyâna*:[2] "Suchness is neither that which is existent, nor that which is non-existent; it is neither that which is at once existent and non-existent, nor that which is not at once existent and

[1] The term *dharmakâya* is very difficult to define. Neither "essence-body," "law-body," nor "being-system" exactly expresses its idea. "Dharma" is a very comprehensive term in Buddhist philosophy, and in this case it means all this: essence, being, law, and doctrine. In short, let us understand "Dharmakâya" here as the source, the ultimate reality, from which is derived the reason of existence, morality, and religion.

[2] Translated into English by the present author from the Chinese translations, 1900. A new revised edition will be issued in the near future.

non-existent; neither that which is one, nor that which is many; neither that which is at once one and many, nor that which is not at once one and many....It is altogether beyond the conception of a finite mind, and the best way of defining it is to designate it 'suchness.'"

Nâgârjuna, the founder of the Mâdhyamika school of Buddhism in India, who was as great as Ashvaghosha, declares in his *Book of the Mean*: "No birth, no death, no persistence, no changing, no oneness, no manyness, no coming, no going: this is the doctrine of the mean." Again, "To think 'it is' is eternalism: to think 'it is not' is nihilism. To be or not to be, the wise cling to neither."

All these statements have been construed as nihilistic, leading the mind nowhere but to absolute emptiness. But, as I have said before, such critics entirely ignore the fact that the human understanding, owing to its constitutional limitations, often finds it most expedient and indeed most logical to state a truth negatively, since a negation is really a higher form of affirmation, to be comprehended only through a process of intuition. The Mahâyâna thinkers have denied with their conservative fellow believers the existence of a concrete ego-soul; they have refused to accept the doctrine of a personal God; they are further reluctant to assert anything dogmatically; and the ultimate logical sequence of all these necessarily negative statements could not be anything else but the conception of suchness. Beyond this, one enters into mysticism; philosophy must bow her head modestly to religion at this gate of suchness; and religion must proceed by herself into an unknown wilderness, or to Eckhart's *stille Düsterniss* or *Wüste,* or to Boehme's *Abgrund*;—this is the realm of "Eternal Yea," or, which is the same thing, the realm of "Eternal Nay." The Mahâyâna philosophy at this point becomes mysticism. Intellectually, it has gone as far as it can. *Vidya* must now give way to *dhyâna* or

prajñâ; that is, intellection must become intuition, which is after all the ultimate form of all religious discipline. Mysticism is the life of religion. Without it religion loses her reason of existence; all her warm vitality departs, all her inexpressible charm vanishes, and there remains nothing but the crumbling bones and the cold ashes of death. I have said before that the Mahâyâna is highly speculative, but I must add that it is also most deeply and thoroughly religious.

It is apparent that with the conception of suchness, the Mahâyâna speculations have reached the highest peak, and upon this summit stands the religious edifice of Mahâyâna Buddhism. Superficially, the Mahâyâna seems widely different from the Hînayâna; but when its development is traced along the lines indicated above, one will readily comprehend the fact that in spite of the disparity existing between the two *yânas* of Buddhism, the Mahâyâna which started intellectually and culminated in mysticism, as every religion should, is really no more than a continuation of the Hînayâna.

When the conception of suchness is established, the *raison d'être* of the Mahâyâna becomes manifest. Buddhism is not an agnostic system of philosophy, nor is it an atheistic ethics. For in suchness, or *dharmakâya*, it finds the reason of existence, the real reality, the norm of morality, the source of love and goodness, the fountainhead of righteousness, the absolute intelligence, and the starting-point of *karma*, the law of deeds. For suchness, according to Mahâyâna thinkers, is not merely a state of being, but it is energy, intelligence, and love. But as suchness begins to assume these attributes, it ceases to be transcendental suchness, it is now conditional suchness. So long as it remains absolutely transcendental, in which neither negation nor affirmation is possible, it is beyond the comprehension of the human understanding; suchness can not

very well become the object of our religious consciousness. But there is the awakening of the will in suchness, and with this awakening we have conditional and self-limiting suchness in place of the absolute unknowable. As to the reason and manner of this process the human mind has to confess a profound and eternal ignorance. It is in this transformation of suchness that the Mahâyâna system perceives the religious significance of *dharmakâya.*

The *dharmakâya* is now conceived by the human heart as love and wisdom, and its eternal prayer is heard to be the deliverance of the ignorant from their self-created evil *karma* which haunts them as an eternal curse. The process of deliverance is to awaken in the mind of the ignorant the *samyaksambodhi,* the most perfect wisdom, which is a reflection in sentient beings of the *dharmakâya.* This wisdom, this *bodhi,* is generally found asleep in the benighted, because a sort of spiritual slumber results from the narcotic influence of the evil *karma,* which has been and is being committed through the non-realization of the presence of the *dharmakâya.* Deliverance or enlightenment consists, therefore, in making every sentient being open his spiritual eye to this fact. It is not his ego-soul that makes him think, feel, desire, or aspire, but the *dharmakâya* itself in the form of *bodhichitta* or wisdom-heart which constitutes his ethical and religious being. If we abandon the thought of egoism and return to the universal source of love and wisdom, we are released from the bond of evil *karma,* and we are enlightened as to the reason of existence; in short, we are Buddhas.

In trying to make a sentient being realize the presence in himself of the *bodhichitta,* the *dharmakâya* can be said to be working for its own sake, that is, to awake from the spell of ignorance. Here is involved a great philosophical and religious problem. In the beginning, the *dharmakâya*

negated itself by its own affirmation, and it is now working to release itself from the negation through which this world of particulars was created. This is, as it seems to our limited intellect, an eternal process of suchness: from affirmation to negation and from negation to affirmation. To this mystery of mysteries, however, we fail to apply our rules of syllogism; we have simply to state the fact that, though it seems apparently contradictory, our religious consciousness finds in this mystery something unspeakably fascinating and indeed the justification of its eternal yearnings.

As a consequence of the conception of *dharmakâya* as eternal motherhood and as the source of infinite love, the doctrine of *karma* had somehow to modify its irrefragable severity. And here we observe another phase of differentiation as effected by the Mahâyâna Buddhists from the doctrine commonly held by their ethical, monastic Hînayâna brethren. I do not maintain that the doctrine of *karma* is denied by the Mahâyâna followers. Far from it. They adhere to the doctrine as firmly as the Hînayâna philosophers; they have taken away from it only its crushing effects upon the sinful, who are always too weak and too timid to bear the curse of all their former evil deeds. Or, in other words, the Mahâyâna Buddhists offer a doctrine complementary to that of *karma* in order to give a more satisfying and humane solution to our inmost religious needs. The Mahâyâna doctrine of *parinâmanâ*, therefore, must go side by side with that of karma; for through this harmonious co-working of the two, the true spirit of Buddhism will be more effectively realized.

The doctrine of *parinâmanâ* is essentially that of vicarious sacrifice. Apparently, it contradicts the continuity of the action of *karma*; but in Mahâyâna Buddhism *karma* is conceived in its cosmic rather than in its individualistic aspect, which makes it possible to reconcile the

two notions, *karma* and *parinâmanâ*. I will try to make this clear.

First, what does *parinâmanâ* mean? It means "to bend," "to turn about," or "to deliver," or "to transfer," or "to renounce," for which the early Chinese Buddhists have *hui hsiang*, which means "to revolve and be directed towards," that is to say, "to turn a thing about and hand it over to another." The doctrine of *parinâmanâ*, then, is to turn one's merits over to another, to renounce oneself for others, to sacrifice oneself for the sake of others, to atone for others' evil *karma* by one's own good deeds, to substitute oneself for another who according to the law of *karma* ought to suffer himself. Or, to use Christian terminology, the doctrine of *parinâmanâ* is in its principle that of vicarious sacrifice; with this difference, however, that while in Christianity vicarious sacrifice means the death of Christ on the cross for the sins of all mankind, the Mahâyâna philosophy does not confine the principle of vicarious sacrifice to a solitary historical incident. Christianity is built upon the history of a person, whatever its intrinsic authenticity may be, and not directly upon the facts of our religious consciousness and intellectual necessity. Therefore, it is unable to uphold the universal application of the principle of vicarious sacrifice, not to say its inability to appreciate the importance of the principle of *karma*. This is where Christianity derives its strength, the strength of concreteness and objectivity, as compared to Mahâyâna Buddhism; but here lies also its weakness, at least so it would seem to Buddhist thinkers.

The notion of *parinâmanâ* is based upon the following truths: The universe, according to the Mahâyâna, is a grand spiritual system composed of moral beings, who are so many fragmentary reflexes of the *dharmakâya*. The system is so closely knitted together that when any part of it or any unit composing it is affected in one way

or another, good or bad, all the other parts or units must be drawn into the general commotion that would follow, and will share the common fate. This subtle spiritual system of which all sentient beings are parts or units, is like a vast ocean in which the eternal moonlight of *dharmakâya* is reflected. Even a faint wavelet which is noticed in one part of the water is sure to spread all over its surface sooner or later according to the resistance of the molecules, and thus finally to disturb the serenity of the lunar image in it. Likewise, with every deed, good or bad, committed by any sentient unit of this spiritual organization, the *dharmakâya* rejoices or is grieved. When it is grieved, it wills to counteract the evil with goodness; when it rejoices, it knows that so far the cause of goodness has been advanced. Individual *karma,* therefore, is not after all individual; it is most intimately connected with the whole. It is not an isolated phenomenon originating from the individual and returning to the same agent. It is no mere abstraction when I say that the lifting of my arm or the moving of my leg is not an accidental, indifferent act, but directly related to the ultimate cause of the universe.

This assertion appears with an immeasurably greater emphasis with reference to an act which has a moral bearing. "If," we may ask, "in our spiritual plane of existence things are so intimately related to one another, why could we not make the merit of our own deeds compensate or destroy the effect of an evil *karma* created by an ignorant mind? Why could we suffer ourselves for the sake of others and lighten even to the smallest degree the burden of evil *karma* under which weak, ignorant ones are groaning, though they have nobody else to blame for their own wretchedness?" These questions are answered affirmatively by the Mahâyâna Buddhists. For they say: "It is possible for us to dedicate our own good *karma* to the cause of universal goodness, and to suppress or crush or to make

quite inefficacious the evil *karma* perpetrated by the ignorant. It is possible for us to substitute ourselves for others and to bear their burden upon our own shoulders in order to save them from their self-created curse." The result of this conviction is the doctrine of *parinâmanâ*.

In this, however, it is seen that quite in accordance with the cosmic conception of *dharmakâya,* the Mahâyâna philosophers emphasize the universal or supra-individual significance of *karma* more than its solitary, individual character. In the Hînayâna system, the conception of *karma* is individualistic, pure and simple; there is no escape whatever from the consequence of one's own evil or good deeds, for it follows one even after death which is merely another form of birth. The Mahâyâna Buddhists believe in this as far as the law of causation is concerned; but they go a step further, and assert that *karma* also has its cosmic or supra-individual aspect, which must be taken into consideration, when we want to realize fully the meaning of our spiritual existence. Though a man has to reap what he has sown and there is no escape possible from the consequence of his evil deeds, the Mahâyâna thinkers would say: A Bodhisatva wishes from the fulness of his heart to turn over whatever merit he can have from his acts of goodness to the general welfare of his spiritual kingdom, and to bear upon himself whatever burden of evil is going to befall his ignorant, self-destroying fellow-beings. The good he does is not necessarily for his own benefit. In whatever deed he performs, he does not forget its universal character; above all, he desires to be of service in any capacity whatever to the whole spiritual organization, of which he is a unit.

Therefore, the doctrine of *parinâmanâ* is no more than that of vicarious sacrifice. It is in point of fact vicarious sacrifice in that a Bodhisatva wishes to bear the burden of evil for the real offenders and to save them from suffer-

ing. But when he works to add to the general "stock of goodness" and to nourish the "root of merit" in this world, he is doing more than mere substituting; he is doing something positive. *Parinâmanâ* is vicarious sacrifice, self-renunciation, the transference of merit, the promotion of universal goodness, the annihilation of me and thee, the recognition of the oneness of all things, and the complete satisfaction of our inmost religious yearnings.

The doctrine of *karma* is terrible, the doctrine of *parinâmanâ* is humane: *karma* is the law of nature, inflexible and irreconcilable; *parinâmanâ* is the heart of a religious being, filled with tears: the one is rigidly masculine and knows no mercy whatever; the other is most tenderly feminine, always ready to weep and help: the one is justice incarnate; the other is absolute compassion: the one is the god of thunder and lightning, who crushes everything that dares resist him; the other is a gentle spring shower, warm, soft, and relaxing, and helping life to grow: we bow before the one in awe and reverence; we embrace the other as if finding again our lost mother; we need the one, for we must be responsible to the *dharmakâya* for our thoughts, feelings, and deeds; but we cannot let the other go as we need compassion, tolerance, humaneness, and lovingkindness. Mahâyâna Buddhism can thus be said to have a singularly softening effect on the conception of *karma*. *Karma* cannot be denied, it is the law; but the human heart is tender and loving. It cannot remain calm and unconcerned at the sight of suffering, however this might have been brought about. It knows that all things ultimately come from the same source. When others suffer I suffer too; why then should not self-renunciation somehow moderate the austerity of *karma*? This is the position taken by the Mahâyâna Buddhists in regard to the doctrine of *karma*.

With the moderation of the principle of *karma*, there

took place another change in the Mahâyâna concerning the ideal man, that is, as to what constitutes the true ideal Buddhist, or what kind of being he must be who really embodies all the noble thoughts and enlightened sentiments of Mahâyâna Buddhism. Arhatship was not satisfactory in this respect, and ceased to be the goal of religious discipline for the followers of the Mahâyâna. They considered the Arhat as not fully realizing all the inmost aspirations of religious consciousness; for is he not a Buddhist who seeks only his own deliverance from the whirlpool of birth and death, in which all beings are struggling and being drowned? So long as *karma* was understood in its individualistic aspect, Arhatship was quite the right thing for Buddhists to aspire after; but *karma* could be interpreted in another and a wider sense, which made the doctrine of *parinâmanâ* possible, and the Mâhayâna Buddhists thought that this was more in accord with the deepest yearnings of a religious being who wants to save not only himself but the entire world as well. Therefore, the speculative Buddhists came to establish the ideal of Bodhisatvahood in place of Arhatship, and for this reason the Mahâyâna is often designated as Bodhisatvayâna in contradistinction to Shrâvakayâna and Pratyekabuddhayâna. (*Yâna* means a vehicle on which sentient beings are carried from this shore of ignorance to the other shore of enlightenment and eternal happiness.)

The development of this ideal of Bodhisatvahood was quite natural with the Mahâyâna Buddhists. Grant that the Hînayâna followers most faithfully adhered to the moral, monastic, and disciplinary life of primitive Buddhism, and that the Mahâyânists in the meantime were bent on the unfolding of the religio-philosophical significance of the teachings of the Buddha, and it will be seen that the further they advanced the wider grew their separation from each other. To the moralists, such a bold flight

of imagination as conceived by the Mahâyâna was a very difficult thing to realize. Moral responsibility implies a strict observance of the law of *karma*; what is done cannot be undone. Good or bad, one has to suffer its consequence; for nobody can interfere with it. Arhatship alone, therefore, could be made the goal of those self-disciplining moralists. With the Mahâyâna Buddhists, however, it was different. They came to look at the import of our moral action more from the point of its cosmic relations, or from that of the most intimate inter-dependence that obtains among all sentient beings in their moral, intellectual, and spiritual activities. With this change of the point of view, they could not but come to the conception of a Bodhisatva whose religion was the realization of the doctrine of *parinâmanâ*.

In point of fact, there are not two Buddhisms. The Mahâyâna and the Hînayâna are one; the same spirit of the founder of Buddhism breathes through both. Only each has developed in its own way, according to the different surroundings in which it has thrived and grown—understanding by surroundings all those various factors of life that make up the peculiarities of an individual or a nation. Lack of communication has hitherto prevented the bringing together of Buddhists and the effecting of a complete understanding of each other. But the time is coming nearer when each will fully realize and candidly admit its own shortcomings, though not oblivious of its advantages, and earnestly desire to cooperate with the other in order to bring about a perfect assimiliation into one uniform system of Buddhist thought and Buddhist practice, and to contribute to the promotion of peace and goodwill towards all beings, regardless of racial or national differences.

DAISETZ TEITARO SUZUKI.

UNIVERSITY OF TOKYO.

DEFINITIONS AND METHODOLOGICAL PRINCIPLES IN THEORY OF KNOWLEDGE.

IN the following article, I propose to suggest some definitions resulting from the analysis of experience suggested in previous articles, and some methodological precepts which I believe to be useful in the later portions of theory of knowledge. It was scarcely possible to state either the definitions or the precepts until we had decided that the relation of acquaintance is fundamental to experience, for almost all definitions and principles that we can adopt will presuppose this theory.

Subjects have been already defined in a previous article as entities which are acquainted with something, and *objects* as entities with which something is acquainted. In other words, subjects are the domain, and objects are the converse domain, of the relation *acquaintance*. It is not necessary to assume that acquaintance is unanalyzable, or that subjects must be simple; it may be found that a further analysis of both is possible. But I have no analysis to suggest, and therefore formally both will appear as if they were simple, though nothing will be falsified if they are found to be not simple.

Cognitive facts will be defined as facts involving acquaintance or some relation which presupposes acquaintance.

It is to be observed that we can define cognitive *facts*, not mental *particulars*, since we have no reason to assume

that subjects are in fact always or ever of a different kind from other particulars. The distinguishing mark of what is mental, or at any rate of what is cognitive, is not to be found in the particulars involved, but only in the nature of the relations between them. Of these relations acquaintance appears to be the most comprehensive and therefore the most suitable for the definition of cognitive facts.

There is, however, a certain difficulty in defining the word "presuppose" which occurs in the above definition. What is intended is to include such relations as (e. g.) attention and judgment, which seem plainly to involve acquaintance with the object attended to or the objects entering into the judgment. But it is not intended to include relations which merely *happen,* as an empirical fact, to occur only where there is acquaintance. In the cases which it is intended to include, the fact that acquaintance is involved seems *a priori* evident, and not merely a statistical occurrence. I do not know what, precisely, is the logical difference between these two kinds of connection, but it seems plain that there is a difference. The kind of connection intended in the definition is what we may call the *a priori* kind; and since the difficulties of the distinction belong solely to logic, we need not investigate them further at present.

Theory of knowledge, or *epistemology,* is more difficult to define. To begin with, no definition can be satisfactory which introduces the word "knowledge," both because this word is highly ambiguous, and because every one of its possible meanings can only be made clear after much epistemological discussion. Then again, difficulties arise as regards the relations of epistemology to psychology and to logic respectively. It is obvious that much of epistemology is included in psychology. The analysis of experience, the distinctions between sensation, imagination, memory, attention, etc., the nature of belief or judgment, in

short all the analytic portion of the subject, in so far as it does not introduce the distinction between truth and falsehood, must, I think, be regarded as strictly part of psychology. On the other hand, the distinction between truth and falsehood, which is plainly relevant to the theory of *knowledge*, would seem to belong to logic, though this is open to some degree of doubt. And in any case, as soon as we reach the theory of judgment, even apart from truth and falsehood, the difficulties encountered are almost entirely logical, and logical discoveries are what are most required for the progress of the subject. It can be shown[1] that a judgment, and generally all thought whose expression involves *propositions,* must be a fact of a different logical form from any of the series: subject-predicate facts, dual relations, triple relations, etc. In this way, a difficult and interesting problem of pure logic arises, namely the problem of enlarging the inventory of logical forms so as to include forms appropriate to the facts of epistemology. It would seem, therefore, that it is impossible to assign to the theory of knowledge a province distinct from that of logic and psychology. Any attempt to mark out such a province must, I believe, be artificial and therefore harmful.

The central problem of epistemology is the problem of distinguishing between true and false beliefs, and of finding, in as many regions as possible, criteria of true belief within those regions. This problem takes us, through the analysis of belief and its presuppositions, into psychology and the enumeration of cognitive relations, while it takes us into logic through the distinction of truth and falsehood, which is irrelevant in a merely psychological discussion of belief. We may define epistemology in terms of this problem, as: *The analysis of true and false belief and their presuppositions, together with the search for criteria of true*

[1] As I have come to know through unpublished work of my friend Mr. Ludwig Wittgenstein.

belief. But *practically* this definition is somewhat wide, since it will include parts of psychology and logic whose importance is not mainly epistemological; and for this reason, the definition must not be interpreted quite strictly.

Data are by no means easy to define, since there are various logically different kinds of data. The simplest kind will be *objects*: in this sense, a given person's data are those *particulars* with which he is acquainted. Even in this very narrow sense, there are, as I shall try to show in subsequent articles, still at least three ways in which data may be given, namely in sense, in memory, or in imagination; but these different ways of being given do not involve corresponding differences in the objects given. On the other hand, we can understand universals, and any primitive understanding of a universal (i. e., any understanding not derived from some other understanding) is in a sense a case of acquaintance, and is certainly sufficient ground for calling the universal in question a datum. What is the correct analysis of the understanding of universals is a difficult question, but such understanding must certainly be included among the data of knowledge. Again, *perceptions of facts* (as opposed to the corresponding judgments) must be included among data; if I see that one thing is to the left of another, or if I observe that the thunder is later than the lightning in a particular case, these perceived facts are certainly among my data. And perceived facts are not always thus particular: general logical facts, for example, are often such as can be perceived. I do not know whether any *judgments* (as opposed to perceptions) are to be included among the data of knowledge: arguments may be adduced on either side in this question. But certainly all epistemologically legitimate inference demands that both the premise and the connection of premise and conclusion should be data, either for perception or for judgment.

I think we may say broadly that *data* include all particulars, universals, and facts, which are cognized otherwise than by inference or by belief not derived from analysis of a perceived fact. Thus the only cognitions which do not give data are (*a*) beliefs obtained by inference, and (*b*) beliefs not obtained either by inference or by analysis of perceived facts. Beliefs of the second kind might be fitly called *prejudices*: it will be a mere accident whether they are true or false. Inferred beliefs, on the other hand, if derived from data and not from prejudices, will be true. But in these remarks we are anticipating the outcome of lengthy discussions which cannot be undertaken at present.

There is another, somewhat vaguer, sense in which the word "data" may be used in epistemology. If we are analyzing some body of knowledge, say physics, with a view to disentangling its truth and falsehood, we may give the name "data" to all the beliefs which we entertain when we enter on the inquiry. In this sense, "data" will be opposed to "premises," and what we have hitherto called data will be more fitly called premises. This usage is convenient in some discussions, but for our present purposes it seems not desirable.

It is a common error to suppose that it must be obvious what are our data in any subject-matter to which we turn our attention. This need by no means be the case, since something may quite well be a datum without the fact of its being a datum being also a datum. There is therefore nothing surprising in the fact that it is often very difficult to discover what our data really are.

I pass now to some methodological principles which may be useful in our subsequent inquiries.

1. *The objects of acquaintance cannot be "illusory" or "unreal."* It is customary to speak of dreams and hallucinations as illusory, and to regard images as unreal in some sense not applicable to the objects of normal sensa-

tions. No doubt there are important differences between the objects commonly considered "real" and the objects commonly considered "unreal." But for purely logical reasons, these differences demand some entirely different analysis. If an object is given in acquaintance, then that object has a certain relation to the subject which is acquainted with it. But this would be meaningless if there were no such object. An object of acquaintance is an object to which it is possible to give a proper name, as opposed to a description; it may become the "this" of attention. Of such an object, it is meaningless to suppose it unreal. A proper name which names nothing is not a proper name, but a meaningless noise. An acquaintance which is acquainted with nothing is not an acquaintance, but a mere absurdity. The conception "unreal" is not applicable to such immediate data, but only to *described* entities. We may say "the present king of France is unreal," meaning that there is no present king of France, but not meaning "there is an entity which is at present king of France and which is unreal." Unreality, in fact, is a notion which owes its origin to grammatical forms. These forms make it possible for the grammatical subject of a sentence to be a description, which is not the name of any constituent of the proposition expressed by the sentence. In such a case, if the description applies to nothing, we may say that the subject is unreal; and if we fail to realize that the unreal subject is merely grammatical, we may come to think that there are entities which are unreal. This, however, is a plain absurdity: given an entity, it is absurd to inquire whether it is real or unreal: there the entity is, and there is no more to be said. Thus the supposition that some objects with which we are acquainted are unreal is one which logic shows to be untenable.

The conclusion that no object of acquaintance can be "unreal" forces upon us a certain attitude of respect

towards dreams, hallucinations, and images. There are, of course, important epistemological differences between such objects and the objects of normal sensation, but these differences belong to a much later and more complex part of the subject. Their *likeness* to the objects of normal sensation is much less realized, but is far more important for our present purpose. Mankind has gradually selected a kind of aristocracy among entities, which it calls the "real" world. But, as Parmenides told Socrates, in philosophy we must not despise even the meanest things; and the entities which mankind has condemned as "unreal" are full of interest and importance. It will be said: "No doubt the things we see in dreams exist in a sense, but it is a purely subjective sense: they exist only because we are dreaming, and are merely parts of our mind." This may or may not be true. I am not concerned at present with the question whether it is true or false. I wish merely to point out the great complexity of what is asserted, and the immense system of knowledge which it presupposes. It is asserted that the objects of dreams exist only because we are dreaming; this means, I suppose, that there is some essential impossibility in such objects existing except when some subject is aware of them. It is asserted that they exist only in our mind; this means, I suppose, that not more than one subject can possibly be aware of them. But to know all this is to have an enormous knowledge of the external world, and to see that it cannot harbor anywhere such objects as I saw in my dream. And there is always the fear that the same proposition might be maintained regarding the things seen in waking life. If dreams are to be given a lower status than waking life, as a source of knowledge concerning the external world, this must be done, not by condemning them *ab initio,* but by showing that the world which is constructed on the assumption that they and waking life have exactly the same *immediate*

reality is one in which dream-objects are less intimately related to *other* entities than are the objects of our waking sensations. In fact, what is *called* the unreality of an immediate object must always be really the unreality of some other object inferred from the immediate object and described by reference to it. This conclusion, we shall find, is of great importance in all problems concerning our knowledge of the external world.

2. *The possibility of error in any cognitive occurrence shows that the occurrence is not an instance of a dual relation.* This maxim is closely connected with our first maxim, and equally has a purely logical origin. We saw that when we are acquainted with an object, there certainly is such an object, and the possibility of error is logically excluded. Exactly the same argument would apply to any two-term relation. But when the occurrence is one which unites the subject with several objects in a single fact, the situation is different. In this case, the several objects may or may not be themselves the constituents of a certain related fact; thus a certain described fact, namely the fact composed, in some specified manner, of the objects of the occurrence in question, may occur in certain cases and not in others. The further explanation and exemplification of this maxim will come better in the account of belief. For the present, its chief importance is negative: where error is possible, something not acquaintance or attention or any other two-term relation is involved. This applies, for instance, to the case of memory, in so far as memory is fallible.

3. *The epistemological order of deduction involves both logical and psychological considerations.* It is obvious that any order of valid deduction must involve *logical* considerations, since the propositions deduced must follow logically from their premises. But given a certain body of propositions of which some are deducible from others, there will be many ways of selecting some among them as

the premises from which the others are to be inferred. Any such set of premises may be called a set of *logical premises* for that body of propositions. In a purely logical problem, in which we do not consider the question whether any of the body of propositions are *known to be true,* conditions of elegance suggest that a set of logical premises should be such that no one follows from the others, and should consist of the smallest possible number of the simplest possible propositions. In epistemology, however, our premises have to fulfil other requisites. We are concerned not merely with truth, but with knowledge; hence our premises should be such as can be known to be true without being deduced from any others of the body of propositions in question. For this reason, a certain artificial naïveté is required in beginning epistemology: we must avoid assuming many things which we firmly believe to be true, but which can only be reached by a process of inference. On the other hand, in order to minimize the risk of error, which always exists in regard to premises, it is wise to include whatever appears to be known without proof, even if it could be deduced from other propositions so known. Thus the set of *epistemological premises* for any body of propositions consists of all those relevant propositions which appear to be known otherwise than by inference, and from which the given body of propositions can be deduced. If some of the epistemological premises can be deduced from others, that tends to confirm our belief in the premises, and does not afford a reason for excluding those that can be deduced. We may call a body of propositions *epistemologically self-contained* when it contains all its own epistemological premises. The propositions constituting our epistemology must, of course, be epistemologically self-contained — except that some of its premises belong to logic; but those that belong to logic ought to be stated. Since the question as to what appears to be known without

inference involves psychology, the epistemological order is partly determined by psychological considerations. The real business of epistemology is largely the discovery of its own epistemological premises; the deductions from them will of course proceed according to the rules of logic, and may therefore be left to the logician.

4. *A knowledge of physics and physiology must not be assumed in theory of knowledge.* This maxim follows from the preceding account of the epistemological order. Physics and physiology belong to our knowledge of what is called the external world; our knowledge of them is obviously dependent upon sensation, and is obtained by methods which the theory of knowledge must investigate. Thus however firmly we may be convinced of the truth of physics and physiology, we must only use this conviction as a means of *testing* our epistemology. not as affording premises upon which our epistemology may build from the start. To take a crude illustration: if we are considering whether or how the sense of sight gives knowledge of physical objects, we must not assume that we know all about the retina, for the retina is a physical object of which we obtain knowledge by seeing it. Thus to assume that we know this or that about the retina is to assume that we have already solved the epistemological problem of the physical knowledge to be derived through sight.

It is to be observed, however, that it would not be a logical fallacy to assume knowledge of the organs of sense for a purely sceptical purpose, i. e., in order to show that no knowledge of physical objects is to be derived from the senses. If it could be shown that the hypothesis that we obtain such knowledge through the senses leads to a theory of the sense-organs which shows that they cannot give such knowledge, then the hypothesis with which we started would have refuted itself, and would therefore be false. But although some such position is sometimes advanced,

and is not *logically* unsound, it is hardly possible that it should be true in substance. The hypothesis that we obtain knowledge of physical objects through the senses is one which is capable of a multitude of forms, according to the view we adopt as to the nature of physical objects. If one view on this point is self-refuting, another may not be, and we can never be sure that we have tried all possible views. Thus a dogmatic scepticism as to the knowledge of physical objects derived from the senses can never be warranted by such arguments as we have been considering. Nevertheless, the possibility is one which it is important to remember, since it affords a test to which any theory as to our knowledge of the external world may be submitted.

It is no doubt the case that our sensations are functions of the sense-organs and the nervous system, but this is not the *primitive* knowledge—it is a scientific inference, and cannot form part of the epistemological premises of epistemology. In epistemology, it is important to reduce our problems to what is actually experienced. Take, for example, such a simple fact as that we no longer see objects when we shut our eyes. A number of immediate experiences have to be combined in order to reach this result. We can know from our own experience that visual objects disappear when we have certain muscular and tactile sensations, which we learn to locate in our eyelids. By shutting one eye in front of a looking-glass we may learn (assuming what we know of looking-glasses) what is the visual appearance of the eyelid when we have the muscular sensation in question. By seeing others shut their eyes, and learning that then they no longer see, we can learn without looking-glasses what shutting the eyes looks like. But all this is a complicated process, learned, no doubt, at an early age, but not known without learning. Thus the dependence of sight upon the eyes is not the sort of thing to be *assumed* in epistemology. And what is true of this

very simple physiological fact is true *a fortiori* of the complicated and difficult knowledge concerning the brain which is sometimes thought relevant to the foundations of epistemology. All such knowledge is excluded by the rule which must guide us throughout our investigation: Seek always for what is obvious, and accept nothing else except as the result of an inference from something obvious which has been found previously. With this rule, a great simplification is effected, and vast masses of erudition can be swept aside as irrelevant.

BERTRAND RUSSELL.

CAMBRIDGE, ENGLAND.

CRITICISMS AND DISCUSSIONS.

THE PROBABLE ORIGIN OF OENOTHERA LAMARCKIANA SER.*

In a series of most interesting articles, B. M. Davis has recently tried to prove that mutability might be a result of previous crosses. This view was first proposed by Bateson and Saunders, and applies especially to the phenomena which *Oenothera Lamarckiana* shows when seeds from the pure strain, and even from pure lines within this strain, are sown, as in the experiments I conducted in my experimental garden. Davis expected to be able to offer the desired proof by showing that *O. Lamarckiana* might be duplicated by crossing two other species of the same group. Up to this time, as a matter of fact, he has not succeeded in producing any form which comes sufficiently near *O. Lamarckiana* to be compared with it.[1] But if he had succeeded in doing so, evidently it would not have been a proof for his assertion, unless his hybrid should show the same degree of mutability as does *O. Lamarckiana*, since we have as yet no means of judging from the morphological characters of a given plant whether its hereditary characters are in a stable or in an unstable condition.

In starting his experiments to produce a duplication of Lamarck's evening primrose, Davis was unfortunate in the choice of species for his combination. He chose *O. biennis* L. and a form which he assumed to be *O. grandiflora* Aiton. It is evident that the first condition of success in such work consists in the purity and the immutability of the species which are to produce the hybrid. If they are already in a mutable condition, it is to be

* Reprinted from the *Botanical Gazette* of April, 1914.

[1] For a successful duplication of an elementary species by means of crossing, see *Oenothera biennis* × *O. cruciata* Nutt. in *Gruppenweise Artbildung*, p. 311.

expected that their hybrids, or at least some of them, may combine the different lines of mutability of their parents; and at all events, the mutability of such a hybrid would be no proof that this phenomenon may be produced by means of crossing. On the other hand, if the species to be crossed, or even only one of them, were not pure, the hybrid might inherit this impurity and show phenomena which might easily be mistaken for mutations.

It so happens that *O. biennis* is in a condition of mutability analogous to that of *O. Lamarckiana,* although not developed to the same high degree. From time to time it produces dwarfs, which are distinguished from it by exactly the same two characters which differentiate the dwarfs of *O. Lamarckiana* from their mother species, namely, low stature and sensitiveness to the attacks of some species of soil bacteria.[2] Moreover, Stomps has shown that *O. biennis* may, although very rarely, double the number of chromosomes in its sexual cells, which in *O. Lamarckiana* produces the two mutants *O. gigas* and *O. semigigas.*[3] As is now generally admitted, *O. gigas* results from the pairing of two mutated sexual cells, each of which has a double number of chromosomes. *O. semigigas,* on the other hand, is produced by the pairing of a sexual cell mutated in the same way, with a normal gamete; therefore it possesses only 21 chromosomes (14+7), while the number in *O. gigas* is 28. As yet, only *semigigas* mutants have been observed coming from *O. biennis,* and it is obvious that the double combination must be much rarer. As a proof of this special kind of mutability in *O. biennis,* however, the observations of Stomps are wholly sufficient.

In quoting these facts, Davis says that if it can be shown "that tested strains of the *biennis* are able to produce new forms of specific rank or even marked varieties, the mutationists would have much stronger evidence in support of the mutation theory than that based on the behavior of *O. Lamarckiana.*"[4] After conceding this strong position to his adversaries, Davis subjects the results of Stomps to a rather sharp criticism, which, unfortunately, is based upon a confusion of two wholly distinct types, namely, *O. biennis*

[2] Stomps, Th. J., "Mutation von *Oenothera biennis* L.," *Biol. Centralbl.* XXXII, 1912, 521-535; also Zeylstra, H. H., *"Oenothera nanella* De Vries, eine krankhafte Pflanzenart," *Biol. Centralbl.* XXXI, 1911, 129-138. Cf. also: *Gruppenweise Artbildung,* 1913, 296-304.

[3] Stomps, Th. J., *op. cit.,* p. 533.

[4] Davis, B. M., "Mutations in *Oenothera biennis* L.?" *Amer. Nat.,* XLVII, 1913, 116-121 (especially p. 116); see also *loc. cit.,* 540-596 (especially p. 567).

L. var. *cruciata*[5] and *O. cruciata* Nutt. He says: "It should be made clear that the form (*O. biennis cruciata*) is recognized in the more recent taxonomic treatments as a true species sharply distinguished from types of *biennis* by its floral characters," and "a cross between these types must certainly be regarded as a cross between two very distinct evolutionary lines and its product as a hybrid in which marked modifications of germinal constitution are to be expected."[6] But, as a matter of fact, the Dutch *O. biennis cruciata* differs from *O. biennis* only in the characters of the petals; in all other respects it is wholly the same, and therefore evidently only a subordinate variety of this species. It has not been dealt with in recent taxonomic treatments, since it occurs almost exclusively in the sand dunes of Holland, where it is produced from time to time by mutation from the mother form (first observed in 1900), without having been able until recently to multiply in the field so as to produce a persistent local variety.[7]

On the other hand, *O. cruciata* Nutt. is quite a different species, with narrow, brownish green leaves, and a different type of branching, of spikes, and of fruits. It grows wild in New York and Vermont, and is well known to all students of the American flora. By some authors it has been considered a variety of *O. biennis*, and this probably is the chief cause of Davis's confusion. The character and the behavior of its hybrids with *O. biennis* have been amply dealt with in my *Gruppenweise Artbildung.*

In the experiment of Stomps, the dwarf and *semigigas* mutations were produced by hybrid strains of *O. biennis* and *O. biennis cruciata,* and it was assumed that such strains would behave as true species in all characters not related to the differentiating marks of the petals. It must be conceded, therefore, that the cross of these two forms may be treated "as though it were the combination of forms within the same species, which have similar germinal constitutions" (Davis, *op. cit.*, p. 117).

But the most clear and simple way of obviating this whole objection is evidently to sow seeds of *O. biennis* of pure descent upon the same large scale as in the former experiment. This has been done, and a dwarf and a *semigigas* form have been produced by this pure line, besides some other mutations.[8] They had the

[5] *Die Mutations-Theorie,* II, 599.
[6] *Amer. Nat.,* XLVII, 1913, 117.
[7] *Die Mutations-Theorie,* II, 599.
[8] Stomps, Th. J., "Parallele Mutationen bei den Oenotheren." *Ber. der Deutsch. Bot. Gesell.,* XXX, 1914, No. 3.

same characters as the former one, and now provide us with the "strong support" asked for by Davis. Moreover, they show that his choice of *O. biennis* for a proof of the assertion that mutability might be produced by crossing immutable species was a most unhappy one.

The second condition for success in this kind of work is, as has been stated, the purity of the types to be crossed. As already quoted, Davis assumes that a cross between two very distinct evolutionary lines may give a hybrid with marked modifications of germinal constitution. This may be applied to his choice of the type which he calls *O. grandiflora,* and which he has made the other parent of his initial cross. He got his seeds from Dixie Landing, Alabama, a locality where Bartram had discovered *O. grandiflora* about a century ago. He assumed them to be of the pure species, but a culture which I made in my garden from seeds kindly supplied to me by Mr. Davis proved to be a mixture, and thereby threw a distinct doubt upon the purity of the station. For this reason I visited Dixie Landing in September 1912, and had the good fortune to be accompanied by Mr. H. H. Bartlett, of Washington, well known for his systematic researches among the wild species of this group. We found the station in a most desolate condition. A small-flowered species *O. Tracyi,* in almost all respects different from *O. grandiflora* had migrated into the same old cotton fields and mixed everywhere with the species of Bartram.[9] On no single field was the original form pure; it was always mixed to such a degree with *O. Tracyi* and with their hybrids that we found it impossible to collect undoubtedly pure *grandiflora* seed from this locality. Moreover, the intermediate types were so numerous (over a dozen) that it was difficult to regard all of them as normal hybrids between only two parents. To produce such a diversity of forms, either one or both of the parents must have been in a mutating condition, or more than two species must have combined in the crosses. In both cases, the material can hardly be considered as a fit starting-point for experiments bearing upon the causal relations of crossing and mutability.

Recently I have shown that besides *O. biennis* some other species of *Oenothera* are actually in a state of mutability, and especially has one of the most common American types thrown off

[9] De Vries, Hugo, and Bartlett, H. H., "The Evening Primroses of Dixie Landing, Alabama." *Science,* N. S., XXXV, 1912, 599-601.

marked mutants in my experiment garden.[10] The degrees of development of this condition, however, are very different in different species. In some of them mutations occur rarely, but they serve to throw a doubt upon the stability of those forms for which no positive results have as yet been won. In other words, we may say that almost all the nearest allies of *O. Lamarckiana* are open to the suspicion of sharing at least some degree of the mutability of this species. There is no use, therefore, in trying to produce mutability by crosses of species of the same subgenus (Onagra) in order to show that this phenomenon is only a result of crossing, as is asserted by Davis.

Moreover, I might point out that the question should be dealt with from a general standpoint and not be limited to the evening primroses. If it should be true that phenomena like those of *O. Lamarckiana* could be produced by crossing immutable species, it would, of course, be of much higher scientific value to produce them in other families or genera, or at least in the other subgenera of the evening primroses. The chance of finding immutable parents for a cross would be far greater and the proof could be given as easily and in many cases with less amount of mechanical work and space in the garden. The line of work chosen by Davis seems to me to be necessarily without any chance of success.

Besides his experimental work, Davis has made some historical researches to discover the origin of *O. Lamarckiana.*[11] Unfortunately he has neglected to visit the Museum d'Histoire Naturelle at Paris, where the herbarium of Lamarck is preserved, and where other valuable documents concerning the first appearance of our species are to be found. For myself I visited these collections in 1895 and reported on the result of my investigations in my *Mutation Theory* (Vol. I, pp. 437-444 of the English edition). In October 1913 I repeated my visit and compared the authentic specimens with the remarks made upon them by Davis. I regret to say that, through his ignorance of the available evidence, Davis has been led to conclusions which are fully contradicted by the herbarium material, both of the "Herbier de Lamarck" and of the "Herbier général" of the Museum. As we shall see, the origin of *O. Lamarckiana* is the same as I have pointed out in my book.

In the herbarium of Lamarck, *O. grandiflora* (Lam.), which

[10] *Gruppenweise Artbildung,* pp. 296-312.

[11] Davis, B. M., "Was Lamarck's Evening Primrose (*Oenothera Lamarckiana* Seringe) a form of *Oenothera grandiflora* Solander?" *Bull. Torr. Bot.*

later was renamed by Seringe and called *O. Lamarckiana,* the name it still bears, is represented by two large flowering specimens. When I studied them in 1895, they were loose on their sheets and bore together the no. 12, indicating that they corresponded with no. 12 *O. grandiflora* of the *Encyclopédie méthodique, Botanique,* by Lamarck.[12] About 1900 they were fastened on new sheets and the numbers have been lost.[13] For convenience, I shall call these specimens *A* and *B,* the former being represented by our pl. XVII, while a photograph of *B* has been published by Davis.[14]

Unfortunately, these two specimens do not belong to the same elementary species, but the question as to which of them is to be considered as the authentic specimen has been answered by all authors in the same way, with the exception of Davis. According to the general agreement, *A* (pl. XVII) is the type of the species. Davis has not seen this specimen, and has based his judgment upon the communications of botanists concerned with systematic rather than with elementary species.

The plant *A* corresponds exactly with *O. Lamarckiana* Ser. as it is now universally cultivated and as I know it from my own cultures. The specimen is evidently a side branch, picked in the autumn, and the flowers, although very large, are not quite so large as may be seen in July and August. It bears no fruits, but the sexual organs of the flowers and the form of the flower buds do not leave the least doubt concerning its identity. The stigma lobes are widely spread and raised by the long style high above the tops of the anthers, and this is one of the best characters of *O. Lamarckiana.* The buds are conical and thick, and not thin as in *O. grandiflora* Ait. For comparison, I have given a group of flower buds (*Bot. Gaz.,* pl. XVII), picked in the autumn also, from my pure cultures. All the other marks correspond to those of the present species, although of course not all of them distinguish it from allied forms.

This sheet bears the label, "d'Amérique sept., tige rameuse,

Club, XXXIX, 1912, 519-533. pl. 37-39; "A Much Desired *Oenothera,*" *Plant World,* XVI, 1913, 145-153; "The Problem of the Origin of *Oenothera Lamarckiana,*" *New Phytol.* 233-241, 1913.

[12] *The Mutation Theory,* I, 442.

[13] The herbarium of Lamarck was acquired by the Museum d'Histoire Naturelle in 1886. Comp. Ed. Bonnet, "L'herbier de Lamarck, son histoire, ses vicissitudes, son état actuel." *Jour. Botanique,* XVI, 1902, 129-138.

[14] Davis, B. M., "Was Lamarck's Evening Primrose (*Oenothera Lamarckiana* Seringe) a form of *Oenothera grandiflora* Solander?" *Butt. Torr. Bot. Club,* XXXIX, 1912, 519-533. See pl. 37. For *A* see *Bot. Gaz.,* April, 1914.

haute de 3 à 4 pieds," in the handwriting of Lamarck. The description in the *Encyclopédie* says of the origin of the species: "Cette espèce est originaire de l'Amérique septentrionale. On la cultive au jardin du Muséum d'Histoire Naturelle (V. S.)."[15] The description, however, quotes some points which are not visible on the herbarium specimen, nor on specimen *B*. It is therefore clear that the author knew his plants from another source still, probably from the living material of the Jardin des Plantes. The most interesting point for us is the description of the fruits: "Le fruit est une capsule courte, cylindrique, glabre, tronquée légèrement, quadrangulaire, n'ayant environ que le tiers de la longueur du tube calicinal."[16] This description wholly agrees with the fruits of the present species, especially if we remember that Lamarck based his description on a comparison with the only other large-flowered form he knew, *O. longiflora*. The short fruits at once distinguish our species from the allied types, such as *O. suaveolens* Desf. and *O. grandiflora* Ait., which have thin and proportionally long fruits.[17]

This character of the fruits shows that the description of the *Encyclopédie* has been based upon specimen *A* and not upon the other one. For although *B* lacks fruits also, it belongs to an elementary species which has long and narrow fruits, as we shall soon see. Here I might point out that in systematic researches of this kind, more value is to be attached to published diagnoses and descriptions than to the material preserved in a herbarium. The older systematists, as a rule, did not take much care of their material, even if they were very careful of their descriptions.[18] The herbarium specimens are often found without their names and without any indication concerning their origin. The rule *descriptio praestat herbario* applies in our special case, even as it does in

[15] V. S. (*vidi siccum*) means that the diagnosis is based on herbarium material.

[16] *Encyclopédie méthodique, Botanique par Lamarck,* Vol. IV, 1796, pp. 550-554. "Onagraire." Twelve species of this genus are enumerated, *O. longiflora* being no. 4, *O. corymbosa* no. 11, and *O. grandiflora* no. 12. A copy of the diagnosis of this last one may be found in my *Mutation Theory* (p. 441) and in the article of Davis. The article in the *Encyclopédie* is not signed and was probably written by Poiret, who prepared many articles in Vol. IV, and wrotes the whole of the later volumes. In the herbarium of Paris some of the specimens may be seen quoted with the authority of Poiret, as, for example, on the sheet *O. suaveolens* Desf., where above that name is written "*Oenothera grandiflora* Poiret Encyclopédie." (Cf. pl. 30 of the article of Davis.)

[17] "L'*Oenothera grandiflora* de l'herbier de Lamarck," *Rev. gén. botanique,* XXV, 1914.

[18] Cf. Bonnett, *op. cit.,* p. 138.

many others. In our case, the description is relatively complete and clear, while in the dried specimen only part of the characters are represented.

For all these reasons I cannot agree with Davis, who says (p. 519) that I made an incorrect determination of the material of my cultures, when I identified it with Lamarck's plant of 1796. The authentic specimen of Lamarck and the description in the *Encyclopédie* correspond as closely with the characters of my plants as dried specimens and descriptions expressed in words ever can.

On the contrary, the specimen *B* is surrounded with doubts. Davis has given a very elaborate description of this branch, comparing it with my *Lamarckiana*. The sheet bears the label "*Oenothera* . . . . [*grandiflora*] . . . . nova spec. flores magni lutei, odore grato, caulis 3 pedalis." The fact that the name *grandiflora* is placed in brackets shows that Lamarck did not wholly trust his identification of this plant with the other one. Perhaps the words *nova species* indicate that he took it to be possibly a different species. Later, Poiret discovered the identity of this specimen with *O. grandiflora* Aiton Hort. Kew. s. p. 2,[19] as has been indicated by Davis. And in De Candolle's *Prodromus* (III, 47) Seringe separated the two types, describing *O. grandiflora* Ait. and *O. Lamarckiana* as different species.

The words *odore grato* point to *O. grandiflora* Ait., which has fragrant flowers, while the flowers of *O. Lamarckiana* Ser. are almost without odor. In the original description no mention is made of the odor, and this shows once more that the specimen *B* was not the authentic one for this description.

Davis has compared the branch *B* with some of his hybrid strains from Dixie Landing[20] and finds a close resemblance. Perhaps the plant of Lamarck was a chance hybrid found in the Jardin des Plantes, and in this case, as Davis says, "we can have no certainty as to the characters of an individual plant unless its seeds have been grown in large cultures."[21] At all events it is not backed by other herbarium material in the Museum d'Histoire Naturelle, so far as I know. If Poiret's opinion that it belongs to *O. grandiflora* Ait is correct, then it has evidently not served as a basis for the description of *O. grandiflora* Lam. (*O. Lamarckiana* Ser.). In

[19] *Encyclopédie méthodique.* Suppl. IV, p. 141. See Davis, p. 522.

[20] At Dixie Landing, Alabama, only hybrid strains of *O. grandiflora* and *O. Tracyi*, perhaps mixed with other species too, are to be found. See *Science, loc. cit.*, p. 399.

[21] Davis, B. M., "A Much Desired Oenothera," *Plant World*, XVI, 1913.

O. grandiflora the fruits are thin and relatively large, for example, 3 cm. long and 3 mm. wide; while those of *O. Lamarckiana* may measure 2.5 cm. in length and 6 mm. in width, making a ratio of $^{10}/_{1}$ in the one case and $^{4}/_{1}$ in the other.[22] The description of the fruits as short, as given by Lamarck, evidently points to the second and not to the first case.[23]

Summing up the main results of this discussion, we find that specimen *A* of the herbarium of Lamarck closely corresponds to the *O. Lamarckiana* Ser. of the present time, and has been taken by almost all authors for its prototype. The specimen *B* differs from it in its general aspect, in the words *odore grato* on its label, and in the opinion of Poiret that it belongs to *O. grandiflora* Ait., this opinion pointing to long and narrow fruits. Personally, it impressed me as having been brought into the herbarium of Lamarck only later on, and as having been placed in the cover of *O. grandiflora* Lam. with a doubt shown by the placing of the name in brackets.

The best proof for the fact that *A* and not *B* is the authentic specimen of *O. grandiflora* Lam. is perhaps given by the specimen in the herbarium of Father Pourret, which was given to the Muséum d'Histoire Naturelle by Dr. Barbier in 1847.[24] It bears the name *Oenothera grandiflora* Lam. written in the clear and beautiful handwriting of the clerk of Pourret. In the same cover there is another sheet of Pourret's collection, on which the same clerk wrote *Oenothera biennis.* Unfortunately, Davis, who did not visit the museum, has mistaken this one for the one studied by me,[25] and has accordingly published a photograph (pl. 38) and a description of it. It is easily seen that this specimen really comes nearer to our present *O. biennis* L. than to anything else.

The plant which Pourret called *O. grandiflora* Lam. agrees wholly with the present *O. Lamarckiana* Ser., and in all respects. It was fastened on its sheet by the clerk of Pourret and consists

[22] L'*Oenothera grandiflora* de l'herbier de Lamarck," *op. cit.*, fig. 1, *b* and *c*.

[23] Davis (*op. cit.*, p. 523) lays great stress on the tips of the sepals, but I cannot find a well defined difference between the two species in this character. He calls attention to the word *sétacé* in Lamarck's description of the sepal tips: "This has been translated by De Vries (*Mutations-Theorie*, p. 317) as *dicke*. The French, however, is from the late Latin word *setaceus*, derived from *seta*, a stiff hair or bristle. The meaning, therefore, is exactly the opposite of that given by De Vries." If the reader will kindly look up my book at the page quoted by Davis, he will find that I have translated *sétacé* by *faden*förmig.

[24] *The Mutation Theory*, Engl. ed., I, 442, n. 2.

[25] *Bull. Torr. Bot. Club. loc. cit.*, p. 527.

of two flowering spikes and two separate flowers. The stigma lobes are seen spread above the anthers in the normal way. The specimens were picked at the beginning of the flowering period and bear no fruits; obviously they were main spikes. They will be recognized at once as *O. Lamarckiana* by any one who has seen living cultures of this species. As I have quoted in my *Mutation Theory* (*loc. cit.*), Spach has written on this sheet "*Onagra vulgaris grandiflora* Spach," which remark also proves the identity with *O. Lamarckiana* Ser. The printed label says "Collection de l'Abbé Pourret, extraite de l'herbier legué par M. le Dr. Barbier en 1847." The main spike measures about 40 cm., the smaller one about 20 cm.

In my book I have also referred to a specimen of *O. suaveolens* Desf. At that time I did not know the Alabama species and believed that *O. suaveolens* Desf. and *O. grandiflora* Ait. were synonyms, as almost all authors did. Therefore I used the two names promiscuously. Last summer, however, I cultivated, side by side, *O. suaveolens* Desf. from Fontainebleau, collected by Dr. Blaringhem, and *O. grandiflora* Ait. from Castleberry, Alabama, collected by myself with Mr. Bartlett. They proved to be wholly different species.[26] So far as I know, the large-flowered Oenotheras, which are now relatively common in the western departments of France, all belong to *O. suaveolens Desf.*, at least all the specimens and cultures on which I based my opinion in 1901 did. The specimen of the Muséum d'Histoire Naturelle, which I referred to especially, has been described by Davis from a photograph which is reproduced on pl. 39 of his paper. Davis, who did not know the *O. suaveolens* as a separate species, called it the flotsam of the herbarium (p. 529); it is, on the contrary, the authentic specimen of Desfontaines, bearing on the label the name *suaveolens* written by Desfontaines himself. The smaller plant, fastened on the same sheet, has another label, saying only *O. grandiflora,* and seems to me to have been fastened on this sheet subsequently. The larger one, however, corresponds exactly with the species which is now growing in many thousands of specimens near Samois on the eastern limit of the Forêt de Fontainebleau, where I visited the different stations with Dr. Blaringhem in October 1913. The long fruits and the thick flower buds do not leave the least doubt concerning the identity of this specimen.

The most interesting discovery in this field of historical re-

[26] "L'*Oenothera grandiflora* de l'herbier de Lamarck," *loc. cit.*

search, however, is that of a specimen of *O. Lamarckiana* Ser. in the collection of Michaux, described recently by Blaringhem.[27] I had the advantage of studying this sheet myself, when I visited Paris in October 1913. The printed label says "Herb. Mus. Paris, Herbier de l'Amérique septentrionale d'André Michaux." There is no further indication of the locality and no name. The specimen is a main spike, picked in the beginning of the flowering period, and without fruits. It is excellently preserved and corresponds in all respects to my cultures of *O. Lamarckiana* Ser. The lobes of the stigma are seen to be widely spread above the anthers. The flowers and flower buds are exactly those of the present species.

André Michaux died in 1802, after having traveled during twelve years through the eastern United States from the Hudson River to Carolina. His celebrated collection constitutes one of the best sources of our knowledge of the flora of those parts of America at the end of the eighteenth century, that is, of the same period in which Lamarck published his volumes of the *Encyclopédie.* His herbarium is at present at the Muséum d'Histoire Naturelle at Paris, and his plants were discribed after his death by his son François André Michaux in a book entitled *Andraeas Michaux, Flora boreali-americana, sistens characteres plantarum quas in America septentrionali collegit Andraeas Michaux.*[28] Michaux had the habit of collecting seeds of as many species as possible, besides his herbarium specimens, and of sending them to Europe to be sown.

This beautiful specimen proves that *O. Lamarckiana* Ser. was a component of the flora of the eastern part of North America at the end of the eighteenth century, and that it has come down to us as completely unaltered as may be shown by old herbarium specimens. Moreover, it tends to make it at least very probable that the European strains, or at least some of them, are derived from the importation of seeds by Michaux. The specimen *A* in the herbarium of Lamarck, designated as "d'Amérique sept." probably belonged to this same strain.

The exact situation of the locality where Michaux collected this specimen is, of course, unknown. Much stress is laid by many authors upon the fact that no wild station for *O. Lamarckiana* has

[27] Blaringhem, L., "L'*Oenothera Lamarckiana* Seringe et les Oenothères de Fontainebleau," *Rev. gén. botanique,* XXV, 1914.

[28] *Editio nova,* 1820, Paris The genus *Oenothera* is dealt with in Vol. I on p. 214; the plant is given under the name of *O. biennis.* For the ground covered by his travels, see the preface and the article of Blaringhem.

been discovered lately in any part of the United States. This argument evidently loses the main part of its weight when we know that it was observed by such a well-known botanist as Michaux. Moreover, this situation is not peculiar to *O. Lamarckiana*; on the contrary, the same condition prevails for the other European species, *O. biennis* L., *O. muricata* L., and *O. suaveolens* Desf., whose original stations in the United States and Canada have not been rediscovered. Even *O. grandiflora,* which is known to occur in Alabama in different localities, is observed there to grow on cultivated soil only, especially on old fields of corn and cotton, and no one knows whence it came. Therefore, if our present ignorance of the origin of *O. Lamarckiana* is adduced in order to throw a doubt on its reality as a good species, the same doubt is attached to its nearest allies, and in fact, to all the dozens of elementary species of the group Onagra which are now being found wild on waste fields and along roadsides all through the United States. Autochthonous stations are not known for any of them.

A most valuable contribution to the clearance of the historical data concerning the origin of *O. Lamarckiana* Ser. has been brought forward by Davis in his criticism of the alleged Texan origin of the present cultivated strain. This was introduced into the trade by Messrs. Carter and Co. of High Holborn in the neighborhood of London, about the middle of the last century. These horticulturists offered the seeds as coming from Texas. But, since then, no botanist is known to have seen the plant in that state, and Davis suggests (p. 523) that the statement might, perhaps, have been caused by a mistake.[29] Now, it is well known that such details are, as a rule, given more in the interest of advertising than in that of pure science. Moreover, no horticulturist likes to offer for sale seeds with the announcement that the same form may be found as a wild flower in his own country.

O. Lamarckiana has been, for many years at least, a component part of the flora of England, growing in many localities, especially on the sand dunes along the coast. The most universally known station is that of St. Anne's on the Sea, near Liverpool, which has been studied by Bailey, Gates, and other botanists, and where the species occur in thousands of specimens. Davis received seeds from different English stations and recognized the plant in the cultures derived from them (*op. cit.,* p. 237). In Lancashire the species locally grows together with *O. biennis* L., exactly as it does

[29] See Davis in *New Phytol.,* XII, 1913, 234.

in the sand dunes of Holland. In such cases it produces hybrids such as I have described under the names of *laeta* and *velutina*, and as Davis has isolated as small-flowered races from those English localities (p. 237).

Now, if we agree with Davis that the seeds of Carter and Co. were derived from some English station, the probability at once arises that these English stations themselves owe their origin to the introduction of seeds from America, either by Michaux himself or by some other botanist of the same period. The history of the species would then become a very simple and clear one. In this respect it becomes of interest to look at the figure published in 1807 in Smith's *English Botany* (Vol. VI, pl. 1534).[30] According to the description accompanying this plate, the "specimen was gathered on the extensive and dreary sand banks on the coast a few miles north of Liverpool, where millions of the same species have been observed by Dr. Bostock and Mr. John Shepherd growing perfectly wild and covering large tracts between the first and second range of sand hills." In this same locality *O. biennis* L. and *O. Lamarckiana* are now growing in the same abundance of individuals, partly separated and pure in different valleys and partly in mixtures which are known to contain also their hybrids. The specimen of 1807 is designated *O. biennis*, but both the flowers have the lobes of their stigma above the anthers, which is a differentiating mark of *O. Lamarckiana*. Moreover, it is the only decisive details, all other characters of the figures applying equally to both species. If it is allowable to trust to this detail, we should be entitled to conclude that the station of Liverpool contained both forms as early as 1807, even as it is known to do at the present time. In this case, *O. Lamarckiana* must be assumed to have been introduced into England about the time of Michaux and Lamarck, and a common origin for the specimens of their herbaria and the wild stations in England becomes highly probable.

The strain of Carter and Co. has been identified by *Lindley* as *O. Lamarckiana* Ser., and the high authority of this eminent botanist confirms my own determination of the same strain, made by comparing it with the authentic specimen of Lamarck.[31]

At all events, the adduced facts indicate a very simple history of our species, which has come down to us unchanged, so far as

[30] Cf. Davis, *op. cit.*, p. 532.

[31] Davis says (*op. cit.*, p. 531): "The identification by Lindley of these plants with *O. Lamarckiana* Ser. was undoubtedly incorrect," but he does not give any reason for this assertion.

we know, from the original American habitat.[32] There is no reason to suppose that it originated as a garden plant, and none at all to subject it to all the doubts ordinarily brought forward against the purity of descent of horticultural forms in general, simply on the ground that some garden plants are of known hybrid origin. *O. Lamarckiana* has remained unchanged through more than a century, and has kept as true to its type as any good wild species. "It is exceedingly fortunate," says Davis (*op. cit.*, p. 527), "that the plant which serves as the type of *Oenothera Lamarckiana* Ser. should have come down to us so well preserved that there is scarcely a doubt of its identity." But the identity is with the species as it is still known under that name. Whether the species was in the same condition of mutability at the time of its first appearance, as it is now, is, of course, a different question.[33]

Summing up the results of this historical investigation, we may say:

1. *Oenothera Lamarckiana* Ser. is represented by specimens in the herbaria of Lamarck, Pourret, and Michaux, and is, so far as this material enables us to judge, at the present time exactly the same plant as it was at that period. It has come down to us, through more than a century, as unaltered and as constant as true species usually do.

2. It has been a component of the flora of the eastern United States, where Michaux collected it and whence Lamarck derived his specimen.

3. At the present time it is a component of the flora of England, and is as well established in that country as is *O. biennis* in different parts of Europe.

4. The strain which is now in cultivation, and which was introduced into the trade about the middle of the last century, was probably derived from some wild English locality, which itself may have come from an introduction into Europe of the seeds, collected either by Michaux himself or by some other botanist of his period.

HUGO DE VRIES.

AMSTERDAM.

[32] Davis says (*op. cit.*, p. 530) "that *Lamarckiana* has come down to us greatly modified, that its parentage is far from pure, that it is in fact of hybrid origin." This assertion, which is not based upon any facts, is clearly contradicted by the preservation in excellent condition of the three specimens of Lamarck, Pourret and Michaux, not known to Davis.

[33] "Ueber die Dauer der Mutationsperiode bei *Oenothera Lamarckiana*," *Ber. Deutsch. Bot. Gesells.*, XXIII, 1905, 382.

PANDIAGONAL PRIME NUMBER MAGIC SQUARES.[1]

For ordinary magic squares the only requirements are that all rows, all columns, and the two main diagonals sum to the constant. For pandiagonal magics it is required in addition that *all* diagonals also sum to the constant.

PANDIAGONAL MAGIC SQUARES OF EVEN ORDERS.

Dr. C. Planck has given us the following rule for transposing all associated magic squares of even orders into pandiagonal magics but the inverse change from pandiagonal to association does not follow in every case.[2]

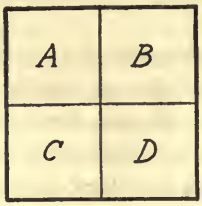

Fig. 1.

73	41	13	113
23	103	83	31
107	7	47	79
37	89	97	17

Fig. 2.

197	71	83	163	37	79
17	97	109	199	179	29
167	151	53	19	103	137
47	173	131	13	139	127
11	31	181	193	113	101
191	107	73	43	59	157

Fig. 3.

271	1	227	353	101	163	503	421
491	439	151	337	137	61	311	113
269	383	47	197	457	443	11	233
131	23	479	281	467	179	79	401
409	347	7	89	239	509	283	157
373	449	199	397	19	71	359	173
53	67	499	277	241	127	463	313
43	331	431	109	379	487	31	229

Fig. 4.

[1] The author is indebted to Messrs. W. S. Andrews and H. A. Sayles, both of Schenectady, N. Y.: to the former for valuable assistance in writing these papers and to the latter for execution of the diagrams.

[2] See *The Monist* for July, 1910, Vol. XX, No. 3, "The Method of Complementary Differences," by W. S. Andrews.

Rule: Divide the square into equal quarters parallel to its sides (see Fig. 1).

Leave A untouched.

Reflect B.

Invert C.

Reflect and invert D.

By this rule the associated magic squares of the fourth, sixth, eighth and tenth orders, (Figs. 2, 3, 4, 5), were transposed from the associated squares shown in the preceding article.

953	607	113	349	919	347	827	337	181	317
127	257	751	421	727	131	23	907	947	659
167	757	571	929	137	547	761	7	103	971
397	109	359	179	739	709	373	977	719	989
557	307	541	911	491	467	53	107	839	677
643	163	653	809	673	37	383	877	641	71
859	967	83	43	331	863	733	239	569	263
443	229	983	887	19	823	233	419	61	853
281	617	13	271	601	593	881	631	811	251
523	937	883	151	313	433	683	449	79	499

Fig. 5.

PANDIAGONAL MAGIC SQUARES OF ODD ORDERS.

It is obviously impossible to construct a pandiagonal magic square of the third order since all squares of this order are made from the same formula which is not a pandiagonal one.

x	y	z	v	t
v	t	x	y	z
y	z	v	t	x
t	x	y	z	v
z	v	t	x	y

Fig. 6.

a	b	c	d	e
c	d	e	a	b
e	a	b	c	d
b	c	d	e	a
d	e	a	b	c

Fig. 7.

1	19	53	101	163
71	157	67	13	29
79	23	47	127	61
103	31	73	89	41
83	107	97	7	43

Fig. 8.

Pandiagonal magics of odd prime orders larger than the third can be made from La Hirian primaries constructed as shown in Figs. 6 and 7, the paths in this instance being knight's moves in different directions.

A pandiagonal magic square of the fifth order is shown in Fig. 8 in which

$x = 1$ $\quad$ $a = 0$
$y = 13$ $\quad$ $b = 6$
$z = 23$ $\quad$ $c = 30$
$v = 41$ $\quad$ $d = 60$
$t = 97$ $\quad$ $e = 66$

and the summation = 337.

1	19	53	101	163	751	857
601	653	211	283	23	47	127
311	97	547	617	61	79	233
43	83	107	307	811	587	7
797	271	13	29	71	157	607
103	571	647	67	223	293	41
89	251	367	541	593	31	73

Fig. 9.

Fig. 9 shows a pandiagonal 7^2, S = 1945, the primaries being as follows:

$x = 1$ $\quad$ $a = 0$
$y = 13$ $\quad$ $b = 6$
$z = 23$ $\quad$ $c = 30$
$v = 41$ $\quad$ $d = 60$
$t = 97$ $\quad$ $e = 66$
$s = 541$ $\quad$ $f = 210$
$p = 587$ $\quad$ $g = 270$

After long perseverance the writer succeeded in finding the unbalanced series of primes for a magic square of the 9th order,

shown in Fig. 10, but there appears to be no rule for making a pandiagonal magic therefrom. It was therefore decided to approach pandiagonal or nasik results as nearly as possible.

	6	4	176	44	70	80	126	880
	1	7	11	137	181	251	631	827	2647
42	13	19	23	149	193	263	643	839	2659
42	31	37	41	167	211	281	661	857	2677
30	61	67	71	197	241	311	691	887	2707
42	103	109	113	239	283	353	733	929	2749
330	433	439	443	569	613	683	1063	1259	3079
1050	1483	1489	1493	1619	1663	1733	2113	2309	4129
858	2341	2347	2351	2477	2521	2591	2971	3167	4987
3306	5647	5653	5657	5783	5827	5897	6277	6473	8293

Fig. 10.

826	6	180	2646	10	250	630	0	136
630	0	136	826	6	180	2646	10	250
2646	10	250	630	0	136	826	6	180
6	180	826	10	250	2646	0	136	630
0	136	630	6	180	826	10	250	2646
10	250	2646	0	136	630	6	180	826
180	826	6	250	2646	10	136	630	0
136	630	0	180	826	6	250	2646	10
250	2646	10	136	630	0	180	826	6

Fig. 11.

1	13	31	61	103	433	1483	2341	5647
0	6	10	136	180	250	630	826	2646

The above La Hirian primaries being laid out in the usual way from the unbalanced series, two primary squares (Figs. 11

and 12) were made according to an arrangement formulated by Mr. H. A. Sayles, Schenectady, N. Y. A combination of these two primary squares produced the magic square shown in Fig. 13,

433	31	5647	61	1	1483	103	13	2341
61	1	1483	103	13	2341	433	31	5647
103	13	2341	433	31	5647	61	1	1483
5647	433	31	1483	61	1	2341	103	13
1483	61	1	2341	103	13	5647	433	31
2341	103	13	5647	433	31	1483	61	1
31	5647	433	1	1483	61	13	2341	103
1	1483	61	13	2341	103	31	5647	433
13	2341	103	31	5647	433	1	1483	61

Fig. 12.

S = 14,979. In this square each third diagonal = S, so that only six diagonals are regular. Each pair of irregular diagonals shows summations $s + x$ and $s - x$; x being different with each

1259	37	5827	2707	11	1733	733	13	2477
691	1	1619	929	19	2521	3079	41	5897
2749	23	2591	1063	31	5783	887	7	1663
5653	613	857	1493	311	2647	2341	239	643
1483	197	631	2347	283	839	5657	683	2677
2351	353	2659	5647	569	661	1489	241	827
211	6473	439	251	4129	71	149	2971	103
137	2113	61	193	3167	109	281	8293	443
263	4987	113	167	6277	433	181	2309	67

Fig. 13.

pair in this square. The writer has attempted to correct these faulty diagonals, but so far without success.

In order to build a nasik square of the 9th order by rule, it is

necessary to find a series which will permit the two sets of La Hirian primaries to be each divided into three groups of numbers having a common summation, as exemplified in the arithmetical series 1, 2, 3, 4.....81. In this series the two sets of La Hirian primaries are

1	2	3	4	5	6	7	8	9
0	9	18	27	36	45	54	63	72

and the above may be rearranged in three groups as follows:

1	5	9	3	4	8	2	6	7
0	36	72	18	27	63	9	45	54

in which each triplet in the upper line sums 15 and each triplet in the lower line sums 108. The difficulty of finding a 9^2 series of prime numbers that will meet the above conditions appears to be insurmountable.

The writer believes the squares in this paper to be of the lowest possible summations, but no claim to that effect is made except in the case of the 4^2, though it is probable that 5^2 and 7^2 are also of minimum summation.

It is hoped that some student of magic squares may be able before long to make a pandiagonal square of the 9th order with prime numbers.

CHARLES D. SHULDHAM.

WYOMING N. J.

PANELED MAGIC SQUARES.*

These squares are made with a central magic square having one or more panels or borders of figures, so arranged that each enlargement forms another magic square.

Paneled magic squares may be either "perfect" or "imperfect," the former being those in which all intermediate squares are magic, and the latter those wherein one or more of the intermediate squares are not magic.

These two varieties are constructed by different rules. The "perfect" squares are formed entirely of couplets, with the exception of the center cells of odd squares, and the inner 4^2 of even squares,

* Diagrams by Mr. H. A. Sayles, Schenectady, N. Y.

while "imperfect" squares may be made with couplets, triplets, quadruplets, etc.

Only perfect paneled squares will be considered in this article and these will be divided into two classes wherein n is respectively odd and even. Furthermore, only prime numbers will be used in their construction.

PANELED MAGIC SQUARES IN WHICH n IS ODD.

In constructing squares of this class of all orders, it is necessary to find

$$4+8+12.....+2(n-1)$$

couplets, each summing twice a certain prime number which must occupy the center cell of the square. The prime numbers forming these couplets must also contain a 3^2 series answering to the following formula:

a	$a+b$	$a+2b$
$a+c$	$a+b+c$	$a+2b+c$
$a+2c$	$a+b+2c$	$a+2b+2c$

After the 3^2 is made from this series the remaining couplets must then be arranged in magic order.

Paneled Magic Square of the 5th Order.

It is obvious that this is the smallest possible paneled square, and it must be formed of a magic 3^2 which is part of and entirely enclosed in a magic 5^2. Twelve couplets must be used in its construction, each couplet summing twice the prime number which is to occupy the center cell. Twelve such couplets can be found, each summing 466, but as 3 is one of the constituent numbers, it can be easily proved by analysis of the congruences (mod. 3) that it is impossible to make a magic square with these numbers. In the next higher available series, each couplet sums 502, and a paneled magic

401	11	263	149	431
419	461	23	269	83
311	59	251	443	191
53	233	479	41	449
71	491	239	353	101

Fig. 1.

square made with these couplets is shown in Fig. 1. In the 5^2, S = 1255 and in the 3^2, S = 753.

Paneled Magic Square of the 7th Order.

For this square a series of 24 couplets is required, and $617 \times 2 = 1234$ is the lowest number which will permit this series of couplets. This series, however, contains a 3 and is therefore inadmissible.

461	1193	311	419	1229	353	521
1151	1277	1049	173	443	263	131
1013	59	1181	23	719	1223	269
191	599	179	641	1103	683	1091
509	251	563	1259	101	1031	773
401	1019	233	1109	839	5	881
761	89	971	863	53	929	821

Fig. 2.

The next series sums $641 \times 2 = 1282$, and Fig. 2 shows a 7^2 which has been made with these couplets, the different summations being, $7^2 = 4487$, $5^2 = 3205$ and $3^2 = 1923$.

Paneled Magic Square of the 9th Order.

This square demands 40 couplets, each summing twice the prime number which must occupy the center cell. Two sets of 40

2087	2441	2477	191	887	863	857	593	1907
2267	1163	2711	1451	2423	71	1097	653	467
2381	2633	41	2729	1553	1361	1151	101	353
2351	1721	2687	2273	401	1427	47	1013	383
317	113	1223	521	1367	2213	1511	2621	2417
491	947	1301	1307	2333	461	1433	1787	2243
761	911	1583	5	1181	1373	2693	1823	1973
821	2081	23	1283	311	2663	1637	1571	1913
827	293	257	2543	1847	1871	1877	2141	647

Fig. 3.

couplets can be found summing 2554 and 2722 respectively, but as each series contains a 3, neither is admissible. There are 41 couplets

summing 2734, one of which contains a 3, and a paneled magic square constructed from the remaining 40 couplets is shown in Fig. 3.

The 3^2 sums 4101, the 5^2 6835, the 7^2 9569 and the 9^2 12303, respectively.

PANELED MAGIC SQUARES IN WHICH n IS EVEN.

To construct these squares

$$10+14+18.....+2(n-1)$$

couplets are required. These couplets need not sum twice a prime number as in squares where n is odd. The panels are made as in the odd squares and the inner 4^2 is formed from such primes as remain over. The summation of the inner 4^2 must be twice that of the couplets.

Paneled Magic Square of the 6th Order.

Ten couplets are required to construct this square. Eleven couplets of prime numbers may be selected summing 144, but a 4^2

97	43	139	1	67	103
61	31	71	7	191	89
23	13	167	101	19	127
109	251	3	29	17	41
113	5	59	163	73	37
47	107	11	149	83	53

Fig. 4.

summing 288 has not yet been found, and it is doubtful if it can be made from the series of prime numbers remaining after the outside panel is finished. The next lowest summation for a series of ten couplets is 150, and a square constructed with these couplets is shown in Fig. 4, wherein the 6^2 has S = 450 and the 4^2 has S = 300.

Paneled Magic Square of the 8th Order.

Twenty-four couplets are necessary for this square, and these can be found summing 330, but they do not appear to contain a 4^2 series. The lowest possible summation for these couplets containing

a 4^2 series is 390, and the square made with them is shown in Fig. 5, wherein the 8^2 sums 1560, the 6^2 1170, and the 4^2 780.

Paneled Magic Square of the 10th Order.

Forty-two couplets are needed for this square, and the lowest possible summation for same is found to be 660. Fig. 6 shows a

379	233	17	151	227	37	149	367
127	197	389	277	7	109	191	263
59	41	3	179	107	491	349	331
139	79	467	269	13	31	311	251
317	347	53	19	479	229	43	73
293	307	257	313	181	29	83	97
223	199	1	113	383	281	193	167
23	157	373	239	163	353	241	11

Fig. 5.

61	587	563	487	103	157	449	571	239	83
137	19	241	263	647	643	409	389	29	523
193	43	349	1	313	281	653	383	617	467
139	59	307	31	107	499	683	353	601	521
197	229	67	79	719	331	191	593	431	463
547	619	613	941	37	233	109	47	41	113
479	607	367	269	457	257	337	293	53	181
509	433	277	659	347	379	7	311	227	151
461	631	419	397	13	17	251	271	641	199
577	73	97	173	557	503	211	89	421	599

Fig. 6.

square made with these couplets, the various summations being, $10^2 = 3300$, $8^2 = 2640$, $6^2 = 1980$ and $4^2 = 1320$.

It will be seen that this brief paper covers all orders of paneled magic squares made with prime numbers up to the 10th order inclusive, and it is believed that all these squares show the lowest possible summations.

WYOMING, N. J. CHAS. D. SHULDHAM.

LATEST LIGHTS AND SHADOWS ON THE JESUS-QUESTION.

I.

In the Waterloo that has now been raging for eight and more especially for three years around the name of Jesus, the Josephine passage (*Ant.*, XVIII, 3, 3; Niese's ed., XVIII, 63, 64) has occupied the position of La Haye Sainte. Ever since the birth of criticism the section has been regarded as spurious by nearly every unfettered inquirer. Scaliger and Casaubon expressed themselves orally and timidly, for one ran considerable risk in doubting the genuineness, but Salmasius and Gronovius boldly in writing, and Blondell and Faber (about 1657) still more boldly. Dubos came to the defense, and there was a lull till Eichstädt renewed the attack in his Jena Program of 1813. Since then the battle has gone more and more against the genuineness, till in 1913 Harnack knew not of a single reputable Protestant savant that defended it, Ranke's and Von Goldschmidt's plea for its partial genuineness being regarded as merely a curiosity. Then it was that F. C. Burkitt, of Cambridge, in the *Theol. Tijdschrift* advanced boldly to the rescue of the testimony, and quickly came to his side Harnack and, later, Professor Barnes in the *Contemporary Review*, January 1914, pp. 57-68.

The reason for this recrudescence of faith in Josephus is not far to seek. In the preceding century the historicity of Jesus had not been seriously questioned, and the critics allowed the obvious facts in the case to have their due weight. Of late, however, all this has suffered a sea-change. Historical? or unhistorical? has become a "burning question of the day," and the need of some external testimony has become importunate, and the anguish at its absence has become poignant almost to paroxysm. "New and more efficient weapons will have to be forged," admits Klostermann, and what else could be half so efficient as the genuineness of the Josephus-passage, which would be the end of controversy?[1]

How has this new apology been received? With practically unanimous rejection. Of course, the multitude have shouted assent, the religious journals have expired a sigh of immense relief, but honest and self-respecting critics, like Linck and Windisch, have not

[1] Unless, as Harnack thinks, Josephus might have "read his account out of the Gospels," in which case his testimony would be "quite indifferent."

been moved in the least. Especially E. Norden, the colleague and compeer of Harnack, has gone over the whole field of controversy from the earliest to the latest, and has dissipated the contentions of Harnack absolutely and completely. Seldom has a work of destruction been so thoroughly done. Norden not unnaturally hopes that we may hear no more of this vain apology, but herein he underrates the toughness of the fibre of faith and the felt necessity of showing that the contemporary Jewish historian and gossiper did take notice of the alleged presence in his own neighborhood of the most impressive and most conspicuous personality the world has ever seen.

It is not strange then that P. Corssen in his article on "The Testimonies of Tacitus and Pseudo-Josephus concerning Christ," read January 20, 1914, in the *Religionswissenschaftliche Vereinigung* in Berlin, published in *Preuschen's Zeitschrift,* May 1914, 2, pp. 114–140, while conceding fully that the passage is a Christian forgery, nevertheless cherishes the suspicion, or rather the hope, that some phrase of Josephus concerning Christ may possibly have provoked the forgery. His reasons for thinking that the phrase "receive the true with pleasure"[2] and "the first among us"[3] are remnants of an ancient Josephine text, seem almost incredibly flimsy. Norden has shown that "receive with pleasure" occurs seven times in this eighteenth book of the *Antiquities,* so that the interpolator could hardly have failed to know that it was a favorite with his author and so would have been tempted to use it in imitation.

Equally important is the fact, which Norden should have noted, that both the phraseology and the idea are good evangelic. "Receive" is a New Testament favorite: "with joy receive the word" is in Luke viii. 13; "receive the word with all readiness," Acts xvii. 11; "the love of the truth they received not," 2 Thess. ii. 10. Harnack indeed protests that a Christian would not have used the word "pleasure"[4] since the word was commonly applied to sense-"pleasure"; but the word is certainly used at least once by a Christian preacher in the thoroughly Christian sense of the joy that comes from performing divine commands (II Clem. Rom. 15): "For however great a pleasure have these words for such as do them, so great a condemnation have they for the disobedient"; moreover, and this is the important point, the dative[5] is a mere

[2] *τῶν ἡδονῇ τὰ ἀληθῆ δεχομένων.*
[3] *τῶν πρώτων ἀνδρῶν παρ' ἡμῖν.*
[4] *ἡδονή.*
[5] *ἡδονῇ.*

adverb and quite equivalent to the adverb,[6] which is used twice in Mark (vi. 20; xii. 37), "the multitude heard him with pleasure," which exactly agrees with the Josephine expression. We too use the noun pleasure (s) generally of the senses; but when one is asked, "Will you do me a favor?" and replies, "Certainly, with pleasure," one means simply gladly, and the sense-reference has quite disappeared. This argument, then, so stressed by Harnack, has no force.

The second phrase criticised by Corssen has its parallel, as he himself admits, both at the beginning and at the end of the *Antiquities,* in the phrase, "the chief priests among us."[7] It is idle to say that the forger would have imitated some more familiar phrase of Josephus.

Corssen himself attaches little weight to such trifles, yet he "nevertheless believes" that he herewith "strengthens the probability of the general reasons that Josephus must have devoted a remark to the fate and significance of Jesus." He thinks further that Luke's professedly exact data as to the date of Jesus's appearance (iii. 1, 2) may have come from Josephus, "who belonged to the priestly circles in Jerusalem, who would have known all about it." Such a reason seems lighter than gossamer. Where, we wonder, did Luke get his equally exact data about the census (ii. 1-3)? If the latter be fictive, as now admitted, why not the former? The combinations that follow in Corssen's articles are equally arbitrary, mere exercises of the imagination. He himself feels and admits as much, for he says towards the end (p. 138), that "it may be better to set bounds to fancy and not pursue the question further." These fantasies are not in themselves plausible, and they lose all assignable probability in the presence of countless "various possibilities."

A general observation may here be allowed. In criticism nothing is more common than to confound the adequateness of an explanation with its probability, and to reason that because it is adequate, therefore it may be accepted and used in further constructions as highly probable. Far from it. An explanation, in itself likely enough, may be very unlikely in the presence of many other possible explanations, none so inherently likely. A favorite racer may look as if he would certainly win, and his record may be excellent, but his chance against the field may all the while be very

[6] ἡδέως.

[7] τῶν παρ' ἡμῖν ἀρχιερέων.

small, and he may actually lose in the race. It is perfectly natural and easy for an ace to turn up in throwing a die, but its chance is only one in six, simply because there are five other faces just as good. When Corssen imagines all sorts of things about Josephus making obscure allusions to the burning of Rome and about Poppæa's slandering the Christians to Nero, not even if his conjectures were far more ingenious, could they have any standing in court, because there is an indefinite number of other ways in which it all might have happened. The unknown historical conditions are practically infinite.

The value of Corssen's article consists not so much in these vagaries of conjecture as in the clear statement of certain facts and in various important admissions, whose full significance he has not indicated. He observes that in Tacitus the notice about "the founder of Christianity and the judgment upon his religion" sits loose in the context (p. 135). He might have added that the whole section is still more plainly parenthetical. "The notice can be removed without disturbing the connection," hence he infers that "the account is from a contemporary source, the notice Tacitus has added." By the same token the whole section has been added, for exactly the same reasons apply with still greater force. The connection is not only not disturbed, it is visibly improved by removing the chapter. Moreover, there are many other reasons set forth in *Ecce Deus,* which are certainly impressive (witness Windisch), which Corssen makes no attempt to answer. One of the minor was the use of the form *humani generis,* instead of the uniform Tacitean *generis humani.* Corssen, however, recklessly quotes this expression twice, both times in the form *odium generis humani* (which T. *would* have used), *never* in the form *odio humani generis* (which the passage actually uses)! Another example of such un-German carelessness is the translation of *heteron ti deinon* as "Something else terrible," which misses the force of *heteron,* "the second of two," and confounds it with *allon,* "something else." Only when we translate correctly do we feel the close connection of Sections 2 and 4, and how it suffers from the insertion of Section 3.

Very valuable is Corssen's declaration that "the tendency to fabricate documents in which the Christian faith was attested even in extra-Christian circles, shows itself at a very early date" (p. 129). *Will historicists all please take notice?* We now ask, would such inventive Christians have hesitated to interlard Tacitus also with an "attestation"? Would they have shrunk from inserting a sig-

nificant phrase here and there in their own documents, both Gospels and Epistles? And since they have admittedly inserted a score, why not twoscore, why not fourscore as well? Is not, in any doubtful case, *the hypothesis of interpolation* antecedently probable?

Very welcome also, and thoroughly just, is his avowal of the primitive unhistorical character of the Gospel stories. The formula "suffered under Pontius Pilate," he tells us, is relatively young. It springs from a time in which an *historic faith* had already developed, for the earlier period it would have been quite without significance (p. 126). "We see indeed how soon the interest of the Gospel tradition in the Personality increases and fancy works on the picture." "None of the evangelists intends in the story of the passion to use Pilate to determine the time of Jesus's death." "The oldest proclamation of Jesus is entirely timeless." Not till Luke (near 100 A. D.) do we enter upon "the new phase. It is the first conscious attempt of a Christian to write history, but reaches no further than the introduction." "It introduces the narrative as real history." Had he possessed sufficient knowledge and wielded such a pen as Corssen's, the author of *Ecce Deus* might have been glad to write such sentences. Enough of this fascinating essay, which lends itself so readily to transcription, but *how in its light will naive historicism adjust its glasses*?

Corssen holds the balance pretty even between his colleagues: He praises Harnack and agrees with Norden. Perhaps it may be in place now to test "the mastership of the trained dialectician." Harnack's paper has had great currency, it is time to try its ring. He argues thus:

1. The notice of Jesus in the passage about James (*Ant.* XX, 9, 1) presupposes Jesus as known; it could hardly have been written by Josephus unless he had elsewhere mentioned Jesus, and he certainly mentions Jesus nowhere else: therefore he must mention Jesus here, *Ant.*, XVIII, 3, 3.

Indeed the dialectic does seem to be excellent. Almost precisely so it is argued in *Ecce Deus*, that since the passage about James presumes an earlier mention of Jesus, and *since there is no earlier mention,* therefore the James passage is also spurious. The sword is two-edged and cuts both ways. Which is right? Since Niese, Norden, Corssen, Linck, Windisch, and nearly all others, *reluctantly* admit the Jesus-passage to be spurious, while only a very few, such as Burkitt and Harnack, force themselves to defend

it, though *all desire with deep desire* that it be genuine, if we merely take the vote, it goes overwhelming against the genuineness: but in that case what becomes of the James-passage? Can it be an insertion? *Most easily,* in spite of Norden's and others' claim that it belongs to the context. It does not. Withdraw the words *ton adelphon Iesou tou legomenou Christou-Jakōbos onoma autōi* and *kai heterous,* and the passage reads "Ananus, then, being such as I have said, fancying he now had a fitting opportunity, since Festus was dead and Albinus was still on the road, assembles a Sanhedrin of Judges, and having brought thither certain ones and having made accusations against them as law-breakers he delivered them to be stoned." Where will you find smoother reading? It is precisely the introduction of James, the Just, that reduces the passage to nonsense; for whatever else James the Just was, a *law-breaker* he was not, but the most fanatical *law-keeper,* even in the New Testament and still more without, as in Hegesippus as cited by Eusebius (H. E., II, 23, 4-18), whose account of the death of James can never be reconciled with this Josephus-interpolation. Besides, the proper appellation of James was not "brother of Jesus the so-called Christ," but "brother of the Lord," a very different thing. The phrase *Jesus the so-called Christ,* is a New Testament phrase and a late one, occurring three times, in Matt. i. 16; xxvii. 17, 22. We can hardly covet the "style-sense" that can attribute it to Josephus. Critics have felt that the James-passage inhered in the context, it seems, simply because they failed to strike out the following words *kai heterous,* which were necessitated by the insertion of the words just before. Of course, it is not meant that all the inserting must have been done by one and the same hand; there may have been two or more working at long intervals. There is then no reason for retaining the James-passage and many reasons for rejecting it, whereby Josephus is rid of all allusion to Jesus and becomes intelligible.

2. The Jesus passage impresses Harnack as insincere—but do we expect much sincerity in a forgery? Such interpolations do often betray themselves in this way.

3. Nay more, it seems to him *patronizing.* And why not? The interpolator is acting the part of Josephus as best he can. Naturally enough he is artificial, stilted, and frigid.

4. The passage says naught good about Christians, but calls them a *nation,*[8] which they never call themselves. But why should

[8] φῦλον = *Sippe.*

the interpolator represent Josephus as saying good of Christians? Why needlessly betray himself? Can we credit him with no worldly wisdom? As to the term *Phylon,* it seems not far away from *Phyle,* the regular term for tribes of Israel, but is rather fitter in place in this passage. In the *Octavius* (VIII) of Minucius Felix the Christians are called exactly similarly a "light-fleeing nation" (*latebrosa et lucifuga natio*). But, says Harnack, that was a heathen speaking. So? The words are *put into the mouth of a heathen* (Cæcilius), but by a Christian, precisely as here they are put into the pen of an unbelieving Jew (Josephus), and with equal fitness. The cases are perfectly parallel: the term is not improbable, it is even probable in a forgery foisted on Josephus.

Harnack thinks the use of *hēdonē* "in the highest degree surprising." But we have just seen that there is nothing at all surprising in it, that not only is it guaranteed by II Clem. 15, but also by the New Testament *hedeōs* in the same connection, the two terms differing exactly as "with gladness" differs from "gladly."

6. Another phrase that surprises Harnack is that "many Jews and many too of the Hellenic race Jesus brought over to himself." He thinks every Christian sadly knew better, that Jesus worked only amid Jews, etc. Herewith Harnack assumes his own view of Christian origins as correct, whereas it is very remote from correctness. But in any case the spread of the Gospel to the Gentiles was much the most imposing part of Protochristianity, and nothing was more natural than to throw the fact back upon the (alleged) great founder. Why, is it not a commonplace of criticism that the life of the early Christian community is constantly reflected in the Gospel narratives about Jesus? What liberal critic calls this in question? Moreover it is stated distinctly in John xii. 20ff. that "some Hellenes of those that went up to worship at the feast" said, "We would see Jesus," and this is accepted by the Jesus as an occasion to declare that he would draw all men to himself (verse 32); and even in Mark i. 37 it is said to him that "all are seeking thee." Granted that all of this taken literally is unhistorical but designed only to set forth the universal conquest of the Jesus-cult, it is still a most ample foundation for the modest Christian statement in Josephus.

Such are the six pillars of Harnack's contention, and they all slip into ashes at the lightest breath of scrutiny. In his eagerness to defend "the historical Jesus," he has shut his eyes to the most obvious matters of fact.

Harnack next proceeds to analyze the Josephine passage and inquire of each clause, whether it *might* not have been written by the Jewish historian. Well, suppose they did *each* sustain the examination—would it indicate that Josephus had actually written it? By no means! It would merely show either that he had written it, or that the forger had been careful to say only what Josephus might have said. But which? There would be nothing[9] thus far to decide, other considerations must be adduced. Not that Harnack does succeed in showing the Jew might have written *each* (even this would not prove he might have written *all*), but merely that the argument is not advanced, even if he should prove it. Only one point need be noticed. The declaration "This was the Christ" Harnack takes to mean "this was the so-called Christ." Why then did not Josephus say so, since according to Harnack he actually does use these words in *Ant.* XX, 1, 9? The whole of Harnack's interpretation is thus exceeding strained and artificial, but it would take too long to treat it minutely, nor is it required. Only be it noted that Harnack admits that he is uncertain about the clause "for he appeared to them on the third day again alive, the divine prophets having spoken both these and myriad other wondrous things about him." Here, he confesses, is "a serious difficulty." He thinks we may get over the resurrection by remembering that "Josephus like nearly all his contemporaries was a believer in miracles" (*wundergläubig*), and that similar stories were told of Apollonius of Tyana,—a venerable slander. But "the prophets etc.," he thinks hard to understand, and perhaps, as Ranke thought, really an interpolation; nevertheless, he reluctantly undertakes a defense, by imagining that Josephus meant to say that all the prophecies were really fulfilled in Jesus, but that the hopes based thereon were only illusions, for the prophesied Messiah was crucified and that was the end of Jewish political aspirations. Such an attitude towards prophecy Harnack admits was "complicated," though he thinks it not impossible. As he lays little stress on this phantasm, it seems needless to discuss it.

But what of the other evidences of spuriousness hitherto held to be decisive, such as the obvious want of connection with the preceding and succeeding sections, and the ignorance of this passage displayed by Origen? Is it not surprising that Harnack has passed all these by in total silence? Even if we concede everything to his

[9] Except indeed the James-passage, the spuriousness of which does throw grave doubt on the kindred passage under consideration.

analysis and synthesis, why does he not mention the very proofs that are regarded as decisive? It is superfluous to repeat these proofs. They are set forth sufficiently in *Ecce Deus,* still more minutely by Norden. They are convincing to such as Linck and Corssen, Windisch, Zahn, McGiffert, Niese, not to speak of elder critics, who would have all possible interest in discrediting them, if by any means possible, nor even of the Benedictine editors of Origen, who seem to go out of their way to discredit the passage (I, 362, n.). Such are the proofs that Harnack does not even hint at. The reader has now before him the argumentation of the "well-trained dialectician" and may estimate its valor and its value.

But what has Burkitt to say? In a paper much shorter than Harnack's, published in the *Theol. Tijdschr.,* II, 1913, 135-144, as well as in his earlier work, *The Gospel History and its Transmission,* Burkitt not only supplies Harnack with his general construction of Josephus's frame of mind, but also feels the necessity of saying something about Origen. The Cambridge Professor thinks this Father's information about Josephus was inaccurate, that he had mixed up things in his commonplace book, that he did not think the passage "proved" anything, and especially that he was unfamiliar with the *Antiquities,* since elsewhere "his reference to the mention of John the Baptist is equally slipshod." [Not at all; Origen cites merely the relevant.] Burkitt thinks Origen may have sold his Josephus (along with other profane books), not for a mess of pottage but for an annuity. On the whole, the Syriac master's paper seems more valuable than Harnack's, less openly partizan and prejudiced. Conybeare, of course, has adopted, as a matter of fact, its modest conjecture about Origen's mixing up in his commonplace book the two notices in Josephus about Ananus's murder of James and his own murder, but in spite of this there may be some correctness in the conjecture. Something similar in the Benedictine note to *Or. c. Cels.,* I, 47: "So perhaps when Origen and others read in Josephus, *Ant.* XX, 8, that the death of James displeased many, afterwards by lapse of memory they thought Josephus had ascribed the overthrow of Jerusalem also to the murder of James."

However, the explanation of Origen's silence concerning the Christ-passage is very far from satisfying. Here there is occasion for historic imagination, such as Burkitt elsewhere displays. Origen was by odds the most learned Christian of his day, one of the most learned of any day. He was engaged in the closest grapple with the

pagan Celsus, no mean antagonist; he was certainly acquainted with Josephus, whom he cites repeatedly, even this very eighteenth book of the *Antiquities*. In his death-grip with Celsus he puts forth his utmost powers, he summons up all the resources of his knowledge and intelligence; he deploys many forces far less effective than the Josephine passage; indeed, there was no other passage anywhere that would have served his controversial purposes so admirably. If, then, he knew of the Josephine section, and regarded it as genuine, it seems incredible that he should have passed it over, that he should have urged so explicitly against Celsus the worthless contemporary testimony of Josephus to the Baptist, in Ch. 5, and have omitted this extremely valuable testimony to Jesus, in Ch. 3, *less than* 300 *lines before*. Even if he had not been familiar with the *Antiquities,* he would have hunted it up, for he must have known that it was the standard work on that period and people, and for him to neglect it would be like neglecting Thucydides in studying the Peloponnesian war. In spite then of Burkitt and his interested assertions, the silence of Origen must cast the darkest doubt on the Christ-passage.

How strong is prepossession and tendency even in Burkitt is vividly shown in the footnote, p. 120, where he would show that Josephus was just the man to believe that Jesus might "appear to his disciples alive": "Note that in *Antiq.*, XVII (end) Josephus tells how the dead Alexander appeared to Glaphyra who had been his wife." Is this quite fair to the reader? Turning to the passage in question we find these words: "And while cohabiting with Archelaus she beholds some such dream as this: She seemed, having beheld Alexander standing near, to rejoice and to enclasp him eagerly, but he made complaint of her and said: [follows his reproachful speech]. Having recounted this to her intimates among the women, after a few days she dies." The reader sees that it was only such a dream (*onar*) as every one has frequently, and in no measure justifies the language of Burkitt. Had the distinguished Syriacist glanced back a few lines, he would have found Origen (*C. Cels.*, I, 46) clearly distinguishing between *hypar* (waking vision) and *onar* (dream).

The Cambridge Professor commends Whiston's Dissertation I as "the best discussion of the problem I have ever read," and approves his idea, revived by Harnack, that Tacitus (*Annals,* XV, 44) derives from this Josephus passage—a notion thoroughly exploded by Norden and Corssen. Burkitt might well prefer Whis-

ton ("paradoxical to the verge of craziness, intolerant to the verge of bigotry") even to Harnack, who takes thence so much, but the Dissertation remains full of naïveté and flimsiness. One thing in it, however, is still valuable: Whiston distinctly and repeatedly admits that it is "almost incredible" that Josephus should have omitted all reference to an historic Jesus. This argument had great weight while the historicity was unquestioned; now, however, the inference is exactly inverted: from the silence of Josephus we deduce that it is "almost incredible" that Jesus was historic.

Neither Harnack nor Burkitt will admit that his interest in the Christ-passage is due to the necessity of defending the historicity. Oh, no! God forbid! Harnack's sole interest is in the unlovely personality of the Jewish historian, and he assumes that "the historic Jesus" needs no defense! Burkitt ascribes the re-opening of the Josephus question to Berendt's discovery of a Slavonic version, which is everywhere justly recognized as a still more elaborate forgery and is scarcely mentioned in recent discussions! All this is very amusing.

Queer that Christendom should rally to such needless defense! One is reminded of Bret Harte's delicious couplet in "The Stage Driver's Story":

> "I have seen danger? Oh, no! not me, Sir, indeed, I assure you:
> 'Twas only the man with the dog that is sitting alone in yon wagon."

Prof. W. Emery Barnes, writing in the *Contemporary Review* of January, 1914, is not only more exact and critical but also more candid than some others; for he states that this "testimony is of no little value at the present day," since this early Jewish witness "supplies testimony of a unique kind to some of the outward facts of the beginning of Christianity, and he blocks the path of those who try to think that 'there is no historic reality' in the figure of Jesus the Christ." Whence it seems that no one really thinks it, though some "try to think it," the dishonest dreamers! What immense gains come to them that "try to think" so, and how noble and self-sacrificing are their opponents, the historicists, will appear distinctly from the following lines from the pen of one of the most illustrious biblicists of this or any other age (I translate from the German): "*Uebrigens* I consider any public discussion of the questions raised by you as not advisable. Moltke hinted once that every expert knew well that not the Crown Prince, afterward Emperor Frederick, but Chief of Staff Blumenthal had won the victories;

but that would not do for the masses; the idea of the victorious Crown Prince was worth a whole army. Therefore neither can you count on any public assent on the part of the representatives of New Testament exegesis in German universities; a German professor of theology who openly agreed with you would have to resign his position. Might he be ever so deeply imbued with the correctness of your views, he would never admit it."

Recent events in German clerical life illustrate the foregoing vividly; however, I can not quite concur. Motives not utterly noble need not be mercenary. Theologians and others feel that they have ancient and venerated interests to guard. If forced to capitulate, it must be on exceedingly honorable terms; the evacuation must look like a voluntary change of base, effected with all the pomp, pride and circumstance of glorious war. Never will they accept the "weird" notions of the "non-professional"—until they rediscover and redemonstrate the same or similar notions in their own minds by their own methods. Such is the decorum of criticism.—The story goes that an able and excellent pastor of a small flock in a country town received a "call up" to a large church in a great city. Naturally he hesitated. Such invitation to a wide and fertile field of usefulness could not be lightly regarded, yet it was hard to break the ties that bound him to his devoted fold. Some friends passing by his residence asked a little child playing on the lawn if the call would be accepted. "I don't know," was the reply; "it's mighty hard to tell. Papa is upstairs now, on his knees, wrestling with the Lord in prayer, and seeking light. But Mama is packing the trunks."

But in any case, when it is scoffingly asked by Harnack and the rest, "Have any of the specialists believed in him?" it is enough to point to the foregoing from a very chief of specialists.

On page 58 Barnes admits that "the doubts survived" the defense by Whiston in 1736; from which the reader would with difficulty deduce that for one hundred years before Burkitt the doubts, not of the genuineness, but of the spuriousness had been steadily disappearing, until "no reputable Protestant scholar continued to defend it" (Harnack), or that even the Benedictine editors of Origen surrendered the passage as spurious. ("The celebrated passage of Josephus concerning Jesus Christ was not extant in the age of Origen, or if extant it was considered spurious and supposititious," I, col. 1911). It takes time and space to note such details, but how else can you discover and uncover the method

and spirit of historicism? It is only since the "testimony" has recently appeared to be "of no little value," in fact indispensable "to block the path" of advancing knowledge, that so many have risen up to discover that it is certainly genuine and impossibly interpolation!

Barnes's arguments, presented clearly, forcibly, systematically, concern themselves mainly with points already sufficiently considered. He analyzes, like Harnack, and finds various things that "could not possibly come from a Christian pen. Could a Christian, who would naturally describe our Lord as the *Saviour of men who received him,* really chill himself down to write 'a teacher of men who receive true words with pleasure'"? Why not? Barnes seems to forget on every page that the Christian interpolator was not a fool, but was more or less clever, that he was impersonating Josephus, and that it was quite proper to appear somewhat reserved and chilly. Barnes appears to understand the feelings of all third century Christians perfectly, and he argues like a man who would defend A charged with forging C's signature by saying: "This can not be a forgery of A's, it must be C's own writing; for I know A's genuine signature and the signatures of all his family, and none of them resemble this present one in question." Such reasoning arouses wonder if not admiration. Barnes seems also to forget that this very "impossible" sentence has notable similars in the New Testament, as already exhibited.

Barnes rejects Whiston's translation, "the truth," as "peculiarly unfortunate" and substitutes "true words,"—still more unfortunately, for it leaves out the article; *t'alēthē* means not "true talk" but "the true," *das Wahre,* as Harnack correctly renders it. Similarly, in the clause "if indeed it be proper to call him a man," he renders *eige* by "since," thus: "Since it is befitting," which he would support by referring to "Liddell and Scott, s. v. *ei.*" Now in the sixth edition (1869) we do read that *eige* "often passes with the sense of *since,*" but not in the eighth, where it is only said "sometimes nearly = since." The passages cited by L. & S. (in the sixth) do not warrant the statement quoted, hence they are omitted from the eighth edition; nor are they now so rendered by the best translators. In all the cases the meaning is "if indeed," and so they put it. To be sure, where the indicative is used the conviction may be very strong, but this lies in the circumstances of the case, not in the form of speech. Professor Burkitt must revise his interested rendering.

He fails to catch any echo of the New Testament in the passage. It would signify nothing if there were none; the Christian interpolator might or might not echo the Christian scriptures. As a matter of fact, the assonances may be faint, but they are audible and in number. Thus *ginitai,* used of a person in the sense of "appears on the stage," "*tritt auf,*" is exceptional and suggests John i. 6 ("Came a man"), 2 Peter ii. 1 ("Came also false prophets"), I John ii. 18 ("Antichrists many have come"), also Mark i. 4 ("Came John the Baptist"). Barnes translates this *ginetai* correctly by "ariseth," Harnack most incorrectly by "lived" (*lebte,* instead of *tritt auf*). The usage smacks distinctly of the New Testament.—"That received the true with pleasure" has already been shown to be evangelic; "the chief men" is not unlike "the head men"[10] of the scripture. "They that loved him at first ceased not" goes well with "having loved his own that were in the world, he loved them unto the end"; the "myriad wonders" rhymes with "the world itself could not contain the books written" of "all that the Jesus did." Also the word uncanny, incredible,[11] used of the works done by Jesus is exactly that put into the mouth of the bewildered folk[12] (Luke v. 26). In the presence of these facts, is it possible to deny that this passage is colored Christian? What other paragraph is like-hued in Josephus? As to whether the general style is Josephine, that being so largely a matter of individual literary feeling, it is perhaps vain to argue. To me it seems not.

It has long appeared hard to believe that Josephus wrote, "This was the Christ," but now Barnes assures us it is certainly "not a Christian confession, the natural form of which would be 'This *is* the Christ.'" Since then it can neither be Christian nor non-Christian, what pray can it be? But why should not a Christian have written, "This was the Christ," a Christian personating Josephus and writing of the distant past? How ridiculous would "this *is* the Christ" have sounded! Barnes seems to forget that in Rev. i. 8 it is declared "I am the Alpha and the Omega, saith Lord the God, which is and which was and which is to come," also that "the Apostle" says "the rock was the Christ," which must mean "the Christ was (or constituted) the rock," and that "God was in the world reconciling etc."

Barnes's arguments about Origen have already been met in

[10] ἄρχοντες.
[11] παραδόξων.
[12] "We have seen παράδοξα to-day."

dealing with Burkitt. He seems to forget that this Father had no especial motive for quoting other things from Josephus, but that he had urgent motives for quoting this passage, for it bears strong testimony to the general historical situation, which Origen had been called on to champion against Celsus and which in that 47th chapter he did actually champion. When Barnes asks what motive a Christian could have in foisting off such a cool and non-committal testimony upon Josephus, the answer is obvious: It was the absence of historic witness to the biographical theory of the Gospel that galled the Christians seventeen and eighteen hundred years ago, *even as it galls them now.* They were intensely concerned to form a biographic substructure for their faith, just as Barnes and Harnack and historicists in general are now compassing sea and land to make one point in favor of their "historical Jesus." Their preferred method was to *make* the testimony they needed and to put it where it would do the most good. Hence the countless Christian interpolations and spurious writings that besprinkle the literature and becloud the history of those early centuries.[13] Does any one doubt this general statement? Let him hear the word of Corssen, who is happily untinctured with the anhistoric heresy: "But the disposition to fabricate documents by which the Christian faith was attested also in extra-Christian circles, shows itself very early. We need only think of the correspondence between Jesus and Abgar of Edessa (ca. 209), of the Acts of Pilate, to which Justin refers his readers for confirmation of the Christian tradition, or of the letter cited as early as Tertullian of the Emperor Marcus Aurelius concerning the rain-miracle that happened to the thundering legion" (p. 129).

It makes no difference at all whether the subtleties of Barnes be just or unjust; the question is not whether this "testimony" is valuable to the Christian in strict logic—why, admittedly the Christians made eager use of Old Testament "testimonies" that had no relevancy whatever—the question is this: Did this testimony *appear* to the Christian to be important? For if so, then he had a motive, logical or illogical, but in any case perfectly adequate, to account for his forging it, and perfectly sufficient to induce him to forgery. Did the Christians then think this "testimony" was to the point? Fortunately we can answer decisively, *they did.* For Eusebius

[13] For evidence to what extraordinary extent and infinite detail this ἐπανόρθωσις of documents was carried, see Norden's *Agnostos Theos,* pp. 122-124.

(A. D. 324-330) quotes the testimony in full, and each time *argues from* it vigorously (in *D. Ev.*, I, 11, and in *H. E.*, I, 11), saying in the latter case: "And since this writer, sprung from the Hebrews themselves, hath delivered in his work these things concerning John the Baptist and Our Saviour, what excuse is there left etc.?" Also Ambrose or Hegesippus (A. D. 360) writing on the destruction of Jerusalem (II, 12) describes Josephus wittily as "an author not to be despised when he writes against himself," quotes the famous passage with proper embellishment at the end, and then argues that the Jews must at least believe their own writers, that their historian's "testimony" is all the more weighty because unwilling and coming from a hard-headed unbeliever. The like may be said of Jerome (A. D. 400), of Chrysostom's pupil Isodorus (A. D. 410), of Sozomon (A. D. 440), of Cassiodorus (ca. 510), and so on down through the long list of writers that have occasion to use this witness. All of these Christians are delighted beyond measure with this "testimony," it seems to suit their purposes precisely. The very clause that Barnes thinks "no Christian could have written," Isodorus cites with especial wonder and admiration. Plainly then Professor Barnes has entirely misunderstood the early Christian consciousness, and all his hair-splitting has been love's labor lost.

Lastly, all of these new defenders miss the main point of the matter, when they pass by in silence the want of connection between the passage and its context, the disjunction both before and after. This has been specially stressed in *Ecce Deus* (pp. 232, 341), later also by Norden, who cites Faber as having also mentioned it. I am pleased to note (to-day for the first time) that McGiffert also years ago rightly judged this consideration to be decisive.

Well, then, the recent knight-errantry fails at *every point* in its championship of the Josephine witness; all its "spearshafts are shivered in the first onset." The passage stands out much more clearly than ever before as interpolation. If so, then is the minor passage about "the so-called Christ" also interpolated; then Josephus has never mentioned "the historical Christ," and this says Whiston, and as so many others like Steck have felt, is "almost incredible" if the Jesus was an historic man; hence again, by the admission of historicists themselves, it is "almost incredible" that Jesus was historical.

Hence the exceeding importance of the whole discussion, hence the desperation with which the "testimony" is defended. Still more,

however, the reader can not have failed to note how frequently faulty are the historicists both in fact and in logic. Why is this? Why do these consummate scholars mar their pages with blunders that even a schoolboy, nay, even an amateur may detect and expose? There is but one answer. They are blinded by passion. Their gift of tongues, their mastery of history, their subtlest analysis, their most ingenious synthesis—all are of no avail; they can not reason aright, they can not translate faithfully, they can not state facts correctly. They are set for the defense of foregone conclusions—as Harnack naively writes: "nevertheless the defense of the sentence seems to me to be not altogether hopeless, and I will try to conduct it"—and their presentations are as scientific and as free from bias as a Catholic priest's who seeks *imprimatur* from His Holiness.

TULANE UNIVERSITY. WILLIAM BENJAMIN SMITH.

THE SIGNIFICANCE OF THE HISTORICITY PROBLEM.

To the Editor of The Monist:

I wish to express my sincere thanks to you in the first place for opening your pages to a discussion of the Jesus-question,[1] and especially for allowing such a full expression to views in which you yourself do not share. There is a growing interest in this subject in Great Britain, and I hope and believe that there will be an increased demand for publications that discuss it.

I wish also to thank you for your contribution to the discussion. I find myself in full agreement with the conclusion to which you come; and not only so, but it is the conclusion in which I am specially interested. As to the question whether there ever was an individual, personal Jesus, I cannot say that I have much interest, nor do I believe that it is a question that can ever be decided. I thought I had stated this point with sufficient clearness in the course of my paper, but it seems that I did not. I did not mean to make the impression that the all important point to me is the question of the historicity of Jesus, as though I wished above all things to prove that no Jesus ever existed! It is so difficult to make one's meaning clear, and unfortunately we must use words

[1] This letter has reference to the preceding number of *The Monist* (July 1914) which was devoted to the subjects of tragedy and the historicity of Jesus. Among other contributions the number contained one by the author of this letter on "The Person of Jesus Christ in the Christian Faith," and another by the editor entitled "The Religion of Tragedy and the Christ-Ideal."

which do not convey our meaning, do what we will. For this reason the very word "historicity" is misleading. I would admit at once that there may have been a historical Jesus; but the point is that he was *not* the significant thing for Christianity, and this, as I understand it, is your conclusion.

The significant thing for Christianity is the timeless, super-historical truth of "dying to live," of vicariousness, which you rightly show is inwrought into the constitution of human life and society. I think that it might be carried a little farther, viz., that it is inwrought into the structure of the universe itself. The cosmos may be the result of sacrifice. A thing is a thing by virtue of its limitation, and limitation is sacrifice. Manifestation is limitation or sacrifice. The old mystics used to say that "creation is the Calvary of Deity," that there could not be a creation without a cross. What, therefore, you show to be true of human life and the destiny of mankind may be true also of the Supreme Spirit itself, or of the Source from which all things come, whatever name we may give to it. This is the essential thing in Christianity, and I think it is supremely important that this should be seen. It is this that gives the Jesus question any interest to me; the mere question apart from this, whether there ever was a man Jesus is to me one of absolute indifference.

Nevertheless I find it exceedingly difficult to make people understand my position, and in spite of all I can do they attribute to me the "spirit of denial." Perhaps I may be allowed to mention an illustration of the difficulty of making my meaning plain: Some years ago I wrote an article for the *Hibbert Journal* under the unfortunate title of "The Collapse of Liberal Christianity." I thought I made sufficiently clear the sense in which I used the word "collapse," namely the failure to find a Jesus who would do for the founder of Christianity. I pointed out that the liberal critics cannot find the Jesus they put at the foundation of their conception of Christiantiy. The Jesus others profess to find they would not thank them for. He would not serve their purpose. The Jesus they posit is a creation of their own imagination.—Well! Prof. Benjamin W. Bacon answered my article, taking me to mean that modern thought has suddenly come to a standstill, and giving reasons why I was mistaken in so thinking!

I now write an article on "The Person of Jesus Christ in the Christian Faith," and you think that I wish to prove that there never was a Jesus! Again I have failed to make my meaning clear.

Behind all the symbolism of the New Testament there may have been a Jesus; I am inclined to think there must have been. But all the same that is not the important thing in the New Testament, nor the most important thing in Christianity, and this is the whole point of your contribution to the subject. I can understand why the Unitarian clings to his "man Jesus." Orthodoxy, or the soul of orthodoxy, may survive after this discussion, but the Unitarianism which is founded on the "man Jesus" is doomed.

K. C. ANDERSON.

DUNDEE, SCOTLAND.

FIFTH INTERNATIONAL CONGRESS OF PHILOSOPHY, LONDON, 1915.

By a resolution passed at the Fourth International Congress of Philosophy, held at Bologna in 1911, an invitation from the University of London to hold the Fifth Congress in London in 1915, with the offer to provide accommodation for the meetings in the buildings of the university was accepted, and the president and the secretary of the congress were appointed.

A general committee of organization has been formed, consisting of the leading students and teachers of philosophy in Great Britain and Ireland, and of representatives appointed by the British Academy. This committee has appointed an executive committee.

The King of England has consented to be patron of the congress, and Lord Haldane, the Lord High Chancellor, has accepted the position of honorary president. The president is Dr. Bernard Bosanquet, the honorary secretary is Dr. Wildon Carr, and the honorary treasurer is Dr. F. C. S. Schiller.

The congress will open on Tuesday evening, August 31, 1915, at the University of London, at eight o'clock, with the presidential address, after which there will be a general reception. The work of the congress will begin on the following morning, and will be continued from day to day until Tuesday, September 7, when the congress will close. The meetings will be held at University College, the general sessions in the mornings from ten till one o'clock and the sectional meetings in the afternoons from two-thirty to five. There will be no meetings on Saturday afternoon or on Sunday, but excursions will be arranged, and will include visits of members to Oxford and Cambridge. Luncheon and tea will be

obtainable during the congress week in the refectory of the college. The whole congress will be accommodated within one building so that the inconvenience due to separation of sections in different institutions will be avoided. It will also be possible, if desired, to hold other meetings during the congress besides those in the regular program. A public dinner, open to all members of the congress and to a limited number of guests, will be arranged to take place on Monday evening. A list of hotels and boarding houses conveniently situated in the neighborhood of University College will be sent to all who have given notice of their intention to attend the congress, and if possible, arrangements will be made for special reductions on railway tickets.

The general sessions will be devoted to the discussion of subjects of wide philosophical interest. The subjects proposed are:

1. "The Nature of Mathematical Truth." In this Professors Royce, Brunnschvicg, Mr. Bertrand Russell and others will take part.

2. "Life and Matter." Professors Bergson, Driesch, Verworn, and Lord Haldane will take part.

3. "Realism." This is the only symposium which is as yet fully arranged. Professors Perry, Meinong, Husserl, Strong, and Alexander will take part in it.

4. "The Philosophy of the Unconscious." Dr. Jung and Dr. Morton Prince will take part in this, and others have been invited.

5. "Pragmatism." Professors Boutroux, Dewey, Enriquez, and others have been invited.

Each subject will be introduced by a symposium of four or five short papers representing different points of view. It is hoped to have all these arrangements for symposia complete in a few weeks, and the introductory papers will be published in a volume to be presented to each member of the congress at the opening. The papers will not be read out at the meetings, but the writers will open the discussion by short speeches giving an analysis of their papers, or developing the point of view put forward, or criticizing the other papers, after which the discussion will be general.

The sections are being organized, each under a president, as follows:

I. General Metaphysic. President, Prof. G. Dawes Hicks.
II. Theory of Knowledge. President, Prof. S. Alexander.
III. Logic. President, Dr. A. Wolf.
IV. History of Philosophy. President, Prof. W. R. Sorley.

V. Psychology. President, Dr. C. S. Myers.
VI. Esthetics. President, Prof. J. S. Mackenzie.
VII. Moral Philosophy. President, Prof. J. H. Muirhead.
VIII. Social Philosophy and Philosophy of Law. President, Prof. L. T. Hobhouse.
IX. Philosophy of Religion. President, Prof. A. Caldecott.

An oriental section or sub-section is under consideration. Proposals to read papers cannot be considered later than April, 1915, but to avoid disappointment early notice is requested, as it is only possible to accept a limited number of papers.

Every member of the congress, whether attending as a delegate or by invitation, or in a personal capacity, subscribes the sum of £1. Ladies are admitted as full members; or, if accompanying members of the congress, they can become associate members on payment of half the subscription. Associate members will be entitled to attend general and sectional meetings, but not to read papers nor to receive a copy of the *Proceedings*.

All communications should be directed to the Secretary of the Congress, Dr. H. Wildon Carr, More's Garden, Chelsea, London, S. W. In particular, it is especially important to inform the committee, as soon as possible, if an intending member proposes to contribute a paper, and to indicate on what subject and for what section it is destined.

Checks and postal orders should be made payable to Dr. F. C. S. Schiller and sent to him at Corpus Christi College, Oxford.

In what precedes, some particulars other than are contained in the printed announcements have been kindly furnished by Dr. Wildon Carr.

In conclusion it may be mentioned that the American members of the Permanent International Committee of the congress are: Prof. J. M. Baldwin (New York), Dr. Paul Carus (Chicago), Prof. G. Creighton (New York), Prof. G. S. Fullerton (New York), Prof. G. T. Ladd (New Haven), Profs. H. Muensterberg and J. Royce (Boston), Prof. J. G. Schurman (Ithaca), and Prof. C. A. Strong (New York). Φ

CURRENT PERIODICALS.

The number of *Scientia* (*Rivista di Scienza*) for July, 1914, begins with an article by Bertrand Russell on "The Relation of

Sense-Data to Physics," which is of special interest in connection with the author's "Lowell Lectures" of 1914 on *Our Knowledge of the External World as a Field for Scientific Method in Philosophy,* which have just been published by the Open Court Publishing Company. Physics, says the author, exhibits sense-data as functions of physical objects, but verification is only possible if physical objects can be exhibited as functions of sense-data. Further, in so far as physics leads to expectations, this verification *must* be possible, since we can only expect what can be experienced. We have therefore to solve the equations giving sense-data in terms of physical objects, so as to make them instead give physical objects in terms of sense-data. This problem leads to much interesting logico-mathematical work. In this paper, a rough preliminary sketch is given. H. A. Lorentz examines those theories of gravitation whose aim, as distinguished from mechanical theories of gravitation, is to bring gravitation into connection with other phenomena and to imagine the nature of the bonds which unite it to these phenomena. Three such theories are here spoken of: (1) Lorentz's own (1900) "electromagnetic theory of gravitation"; (2) The relativist theory of Poincaré and Minkowski (1906 and 1908); (3) The theory of Einstein (1907, 1911, 1914). L. Cuénot maintains that, considering the insufficiency of the classical explanations of adaptation by selection, it is natural to think of adaptation before entry into the environment; and the notion of pre-adaptation falls into line with that of mutations and with the Mendelian theory. Alfred Adler writes on the psychology of the individual, its presuppositions and its results. Raffaele Pettazoni shows that, from its beginnings to its full development, the history of Christianity is closely connected with the universal religious history of humanity. Max Abraham has a critical note on Einstein's article in the May number of *Scientia.* Franco Savorgnan has a general review on social antagonisms. Besides this, there are reviews of books and periodicals, a chronicle of future plans in the scientific world, and French translations of the German, Italian, and English articles.

The *Revue de Métaphysique et de Morale* for July, 1914, contains an address by Gustave Belot, delivered at the School of Advanced Social Studies, on the moral value of science. Etienne Gilson writes on the Cartesian theory of innate ideas and theology. Georges Dwelshauvers writes on religious feeling and its relations with art. G. Aillet has a critical study on Maxime Leroy's book *La Coutume ouvrière.* The "practical question" discussed in this

number is patriotism, and is by G. Siméon. There is the usual supplement containing reviews of books and periodicals, and accounts of recent theses for the doctor's degree at the University of Paris.

The number of *Isis* for June, 1914, is a bulky and interesting one. Yoshio Mikami writes "On the Japanese Theory of Determinants." It will be remembered, from David Eugene Smith and Mikami's *History of Japanese Mathematics,* published not long ago by the Open Court Publishing Company, that Seki Kôwa actually antidated Leibniz in the discovery of determinants. This article gives fuller details. August Georges-Berthier has a long and wonderfully thorough article on the Cartesian mechanical theory of the universe and physiology in the seventeenth century. Aldo Mieli writes on Vannoccio Biringuccio and the experimental method shown in his posthumous *De la Pirotechnia* of 1540. Waldemar Deonna gives some reflections on the theory of the origins of art in its relations with present tendencies. Emile Turrière describes the notion of geometrical transcendence with Descartes and with Leibniz. The indefatigable and self-sacrificing editor, George Sarton, gives (1) a general introduction to a synthetic bibliography of reviews and collections of books, (2) a list of 62 reviews and collections devoted to the history of the sciences. There are also a chronicle of scientific events, analyses of new books and articles, and a continuation of the important critical bibliography.

This journal is published in Belgium and is international. At the present moment, the understanding between nations that is so helped by science is broken by a brutal war whose storm-center is near where *Isis* comes from. Φ

B
1
M7
v.24

The Monist

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

B9 225
289 S5
545/-